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AN INTERIM REPORT ON FREIGHT TRANSPORTATION IN CANADA

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AN INTERIM REPORT ON FREIGHT TRANSPORTATION IN CANADA

JUNE 1975

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Ottawa, 1975

FOREWORD

The material contained in this report was prepared in the course of a review of transportation policy during 1974 and early 1975. It represents a first attempt to develop a comprehensive overview of freight transportation in Canada, and it will be necessary to further refine and update the analysis as additional data becomes available. It is being released publicly at this time to indicate the analytical basis for the Government's review of transportation policy, and to serve as a basis for public discussion. It should be noted, however, that all of the views expressed in this Interim Report on Freight Transportation do not necessarily reflect the views of the Government of Canada.

This report is a companion piece to the Interim Report on Inter-City Passenger Movement, which is being published on the same basis.

Ministry of Transport,
Ottawa,
June, 1975.

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III - FREIGHT TRANSPORTATION

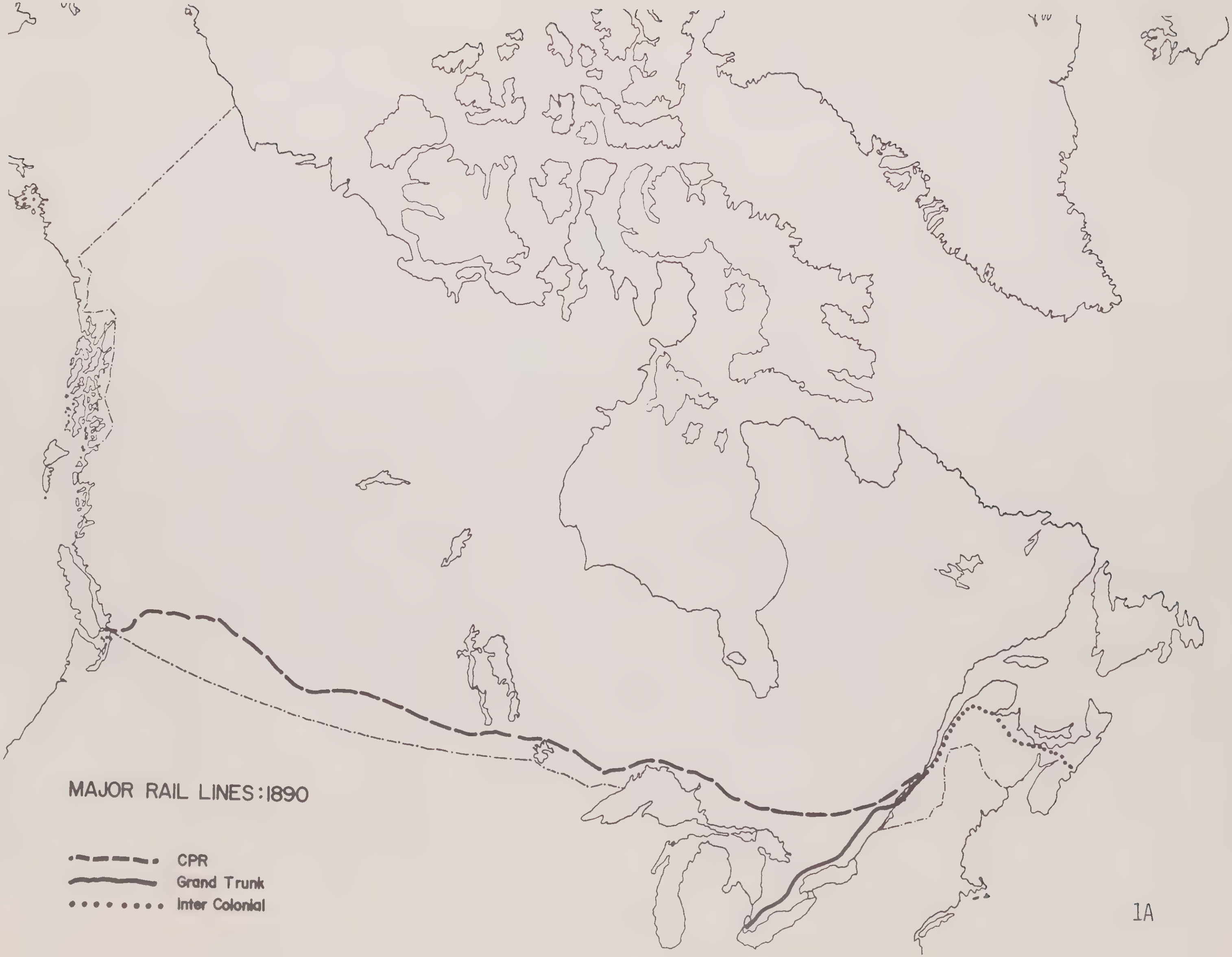
1. THE CONTEXT

This report describes and discusses freight transportation in Canada--past, present and future--outlining the major issues, problems and opportunities. Transportation demands and system expansion/improvement alternatives are considered, as a basis for developing and assessing policy options.

Historical Context

The importance of transportation in shaping Canada's history is obvious. Navigation by ocean-going ships dictated the location of early settlements on the east and west coasts, and inland forts were located at strategic junctions of lake and river travelways. Until the middle of the 19th century, marine transportation was predominant, and strategic canals were built, for reasons of defence and trade, to enhance Great Lakes access.

Construction of rail lines began in the 1830's in Ontario and Quebec and, in the course of a few decades, railways became the backbone of the forming nation. The Intercolonial Railway, joining Montreal and Halifax, was completed in 1876 by the Government of Canada in fulfilment of its promise to the Maritime Provinces as a basis for their joining Confederation. The Canadian Pacific Railway, joining Montreal and Vancouver, was completed in 1885 fulfilling a similar pledge to British Columbia. As shown in Exhibit 1A, the new nation was served from coast-to-coast by 1890 and branch lines were being extended



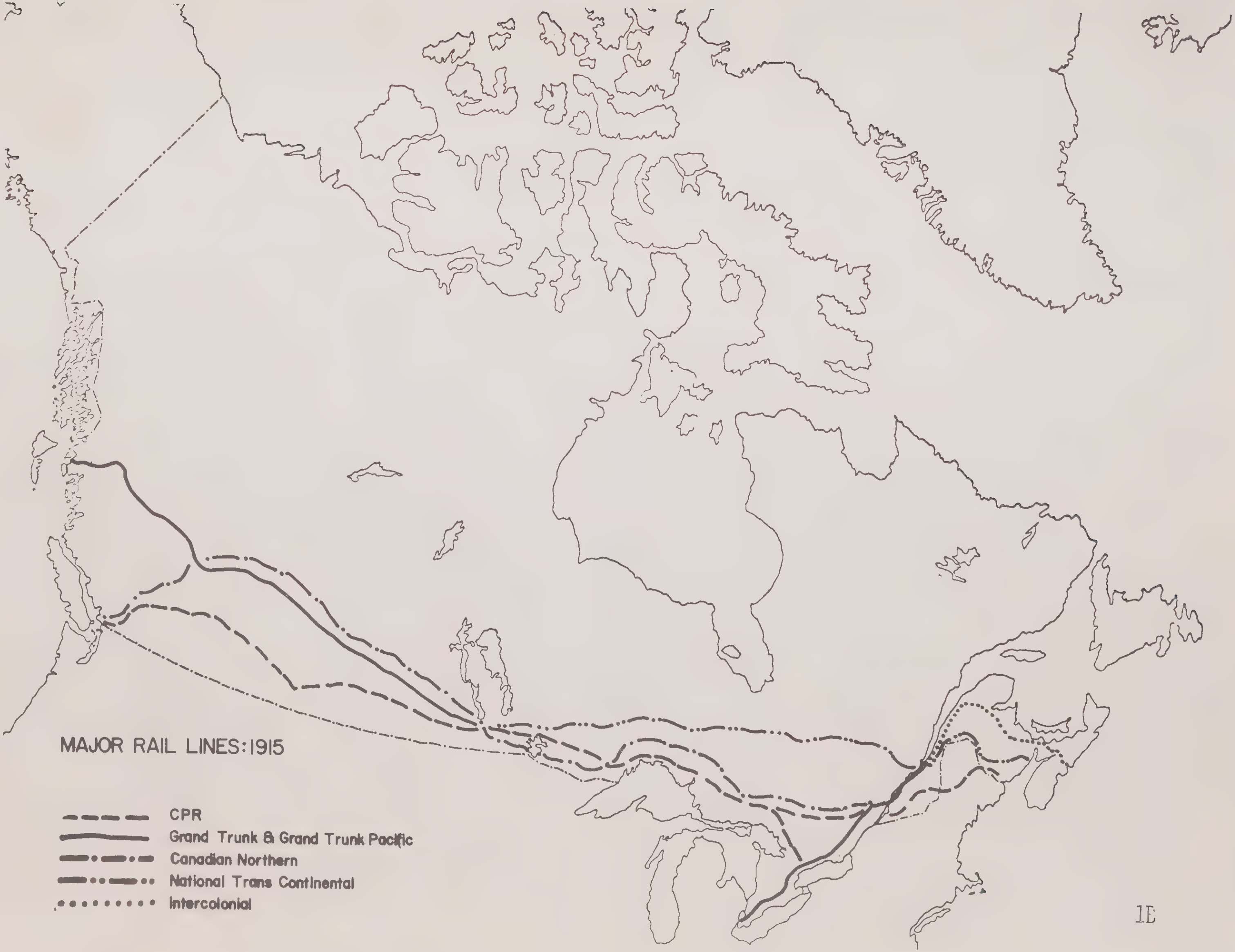
1A

throughout settled and developing parts of the country. The CPR, in particular, was playing a central role in Sir John A. MacDonald's National Policy (good east-west transportation and strong tariff protection from the U.S.), delivering new settlers to the west and their agricultural produce to the east.

By 1915, as shown in Exhibit 1B, over-exuberant investment by several companies had produced no fewer than three transcontinental railways, to serve a nation of 8,000,000 people. During this period also the extensive system of grain elevators and branch lines was put into place for transporting millions of bushels of wheat to a hungry world--a system which is still basically in operation 60 years later.

A lack of economic viability of many of the new rail lines became apparent during the First World War and in 1923 the Government of Canada stepped in to consolidate the Intercolonial, National Transcontinental, the Grand Trunk, Grand Trunk Pacific and the Canadian Northern Railway into one Crown Corporation capable of ensuring the continuance of essential transportation services.

Highways were important for local transportation during the latter half of the 19th century, but assumed growing importance with the advent of automobiles and trucks early in the 20th century. The 1920's saw an explosive growth in road building and paving which has been maintained, with the exception of the Depression and war years, until the present.


MAJOR RAIL LINES:1915
CPR
Grand Trunk & Grand Trunk Pacific
Canadian Northern
National Trans Continental
Intercolonial

1E

The era of intermodality may be said to have begun by the middle of the 20th century. It is characterized by the continuing importance of marine transportation (expansion of ocean ports, construction of the new Welland Canal in 1931 and the St. Lawrence Seaway in 1957), the advent of containers, piggyback and intermodal rail/truck transportation, and the construction of major oil and gas pipelines starting during the 1950's. Air transportation became important as a mover of passengers with the advent of Trans Canada Airlines in 1937; long distance travel in Canada is now dominated by the air mode and it is assuming growing importance for moving high value freight.

Two important conclusions may be drawn from the historical development of transportation in Canada:

1. The presence of major transportation arteries--initially, oceans, rivers and lakes, and subsequently man-made facilities (railways, highways, pipelines, etc.) has been essential for the development and settlement of Canada and its creation as a political entity.

2. Owing to the low population densities, vast distances and harsh terrain of our country, governments has had to play a leading role in actually building major transportation facilities, assisting private enterprise in this regard or stepping in to prevent private transportation companies from going bankrupt, in order to provide and maintain essential transportation services to meet national objectives in the absence of economic viability. Prime examples of such action by government include the following:

   - Canadian Pacific Railway
   - Canadian National Railways
   - Trans Canada Airlines
   - St. Lawrence Seaway
   - Trans Canada Pipelines
   - Trans Canada Highway.

These constitute strong precedents for a major government role in transportation development activities to serve purposes such as defence, political union, economic development, and national sovereignty. With the exception of rail and pipelines, government has financed and retained ownership of transportation infrastructure; it has provided substantial financial assistance also to rail and pipeline, and has, of course, financed and built major airports. Commercial public and private sector companies have tended to finance and own vehicles and, in many cases, terminals, with user charges providing some measure of financial support to the government-owned and maintained infrastructure.

Major Issues - An Overview

In setting the context for a review of freight transportation policy, several major types of issues must be borne in mind. As outlined briefly below, each of these tends to have two distinctive aspects which must be considered: its influence on transportation and the manner in which it is affected by transportation:

Economic/Financial Issues

1. Canadian economic growth and development could vary quite widely during the coming decades due, partially, to our own actions and policies and partially to world economic conditions beyond our control. As discussed in more detail in Section 3 below, the different economic "scenarios" would place substantially different demands on our transportation system; transportation policy and, in particular, capital investment strategy, will have to take into account these uncertainties and the manner in which transportation demands can be influenced by government actions.

2. Conversely, capital requirements to expand and replace the transportation system will be substantial under any of the economic scenarios. It will be necessary to determine whether future investments can be financed from user revenues and the extent to which government action will be required to ensure that necessary transportation developments take place in a financially acceptable manner.

Energy

1. Transportation is a major consumer of energy, with motor vehicles accounting for some 13% of total energy consumed in Canada, pipelines somé 1.5% railways some 1.2%, air transport 1.1%, and marine Transport 1.0%. For freight transportation, oil pipeline transport is the most energy-efficient, followed in order of decreasing efficiency by water, rail, gas pipeline, truck and air. The proportions of freight carried by the various modes at present show a tendency to use energy-efficient modes for major commodity flows; this tendency should be encouraged as a matter of policy, commensurate with differing level-of-service requirements.

2. The transportation of energy places significant loads on our transportation system: in particular, coal by rail and water and oil and gas by pipeline. These loads are expected to grow rapidly in the future; transportation and regional development policies will have to take this, and the associated transportation costs, into account.

Technology

1. There have been substantial improvements in technology and resulting increased in productivity during the past decades. This has meant that (a) transportation rates have risen much less rapidly than the cost of living, and (b) greater tonnages have been moved by rail, ship, truck and air than would have been possible in earlier years using the same infrastructure, owing to larger and more efficient vehicles. If, as is forecast by some, these gains in productivity are less likely to occur in the future, owing to vehicle size and weight limitations, there will be a substantial impact on both rates and infrastructure investments, which will require an appropriate policy framework.

2. Transportation policy will also have to deal with ongoing research and development requirements (a) to ensure that further technoligical and productivity improvements are achieved, and (b) to ensure that such improvements are used to influence transportation investments and modal shares in a manner which best meets national objectives.

Society

1. As indicated in the brief historical review above, transportation has influenced, and will continue to influence, the distribution of people and jobs in Canada, the physical environment within which we live and work, and the economic opportunities and social lifestyles which we are able to achieve. Transportation policy must recognize the need for equity in providing transportation access and pricing which is fair to all Canadians.

2. Conversely, social and political aspirations will affect profoundly the type of transportation facilities and services required. While this is particularly true for passenger transportation, it applies strongly also to goods transport; for example, the degree to which shippers are willing to pay for shorter transit times will affect their propensity to use air and truck as opposed to rail and marine transport, which will affect in turn requirements for additional transport infrastructure close to our major urban centres and the amount of energy which is consumed in transportation.

The above major issues and others not summarized here have prompted the present policy review. A major task of the review process has been to provide information on these issues in an attempt to assess the physical, human, institutional and financial facts and probabilities affecting transportation during the coming decades. In particular, it is important to know whether existing problems are likely to resolve themselves or become worse if present policies are continued and, if necessary, what policy changes would most likely improve the situation. The following three sections of this report provide a summary of the information assembled to date and draw a number of conclusions regarding basic transportation policy options in light of this information.

2. FREIGHT TRANSPORTATION TODAY IN CANADA

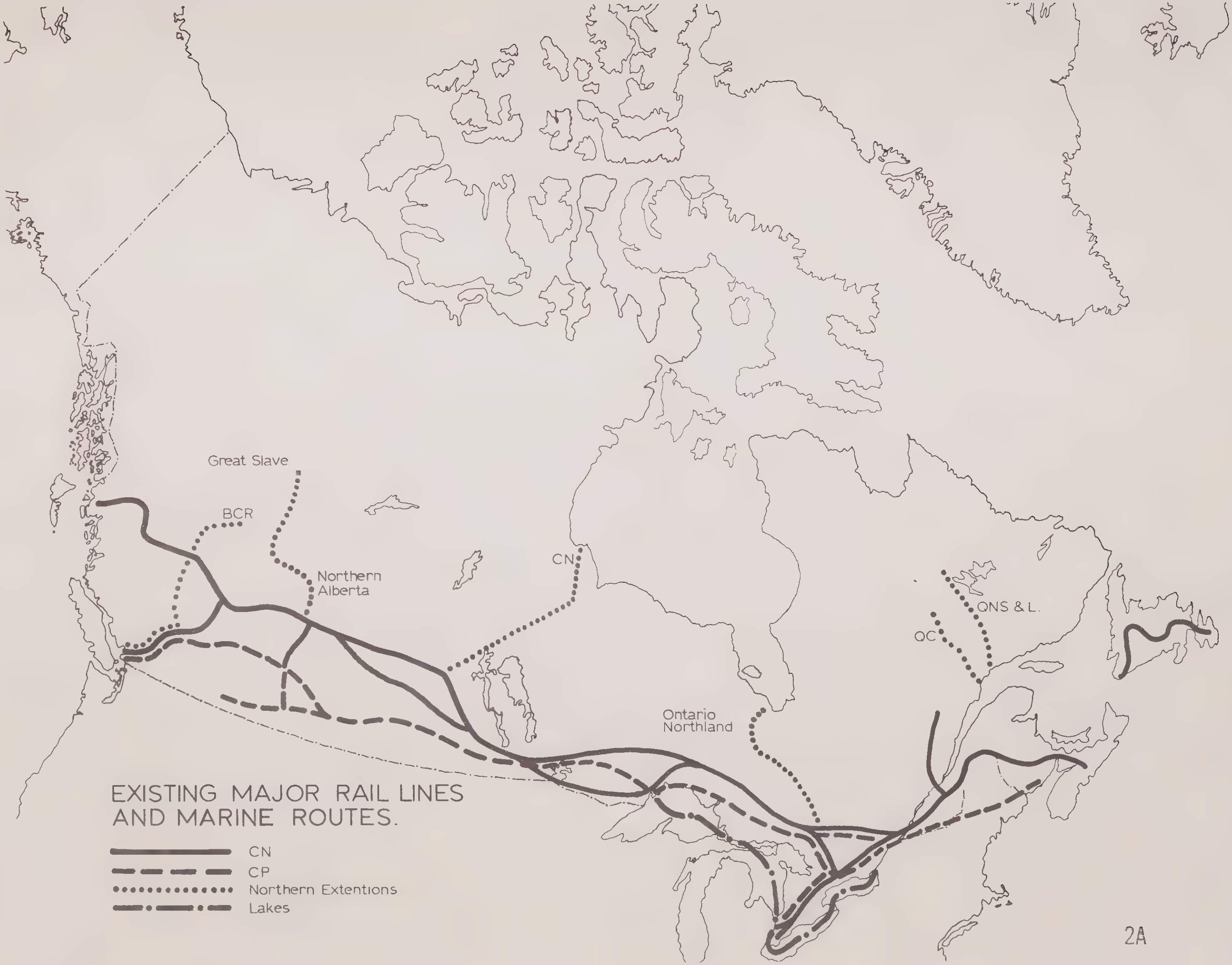
Infrastructure and Traffic

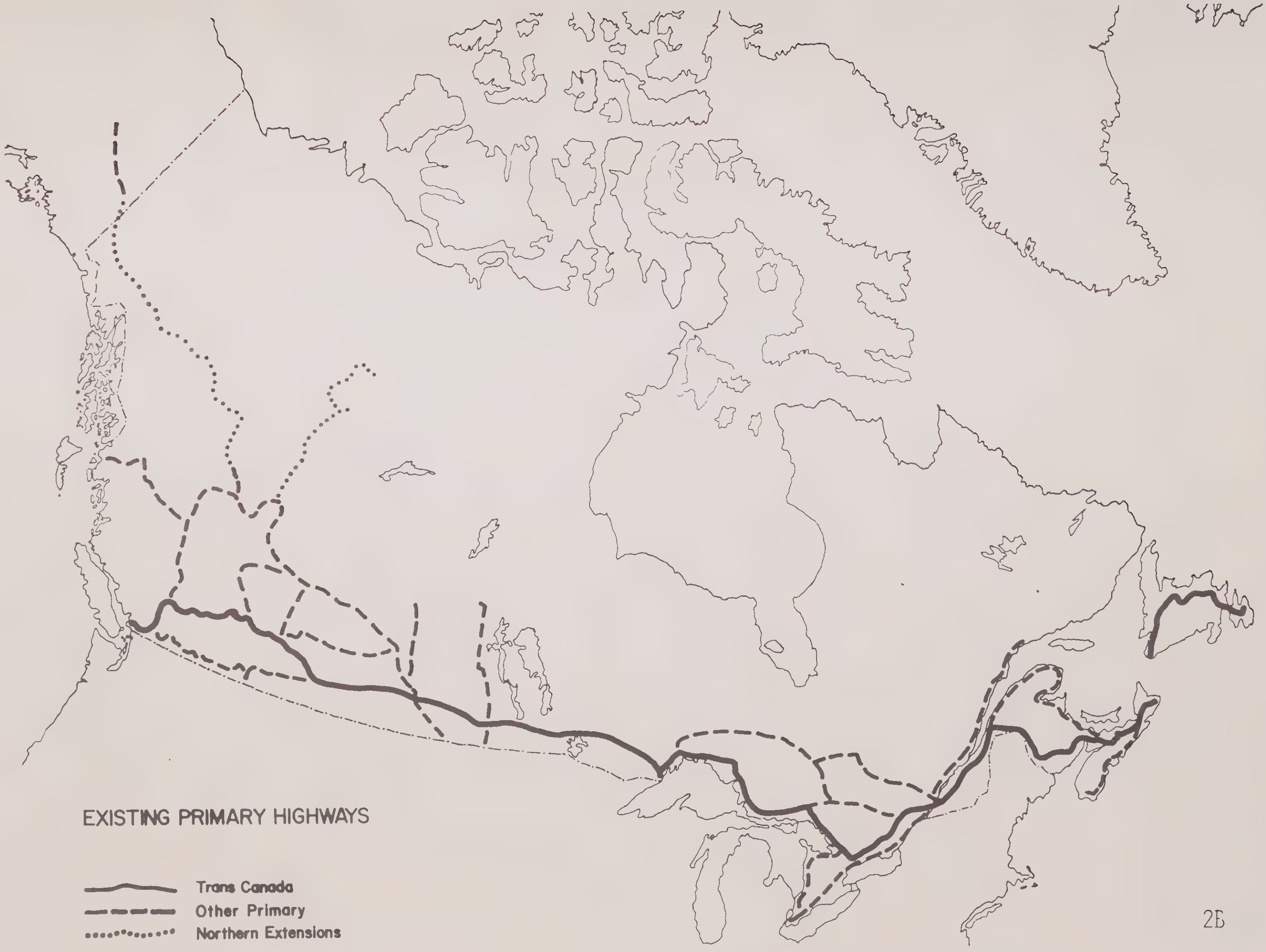
In this section we discuss initially the existing infrastructure (waterways, railways, highways, ports and terminals), traffic levels, and capacity limitations which exist or may be expected during the next few years.

Existing Facilities

Exhibit 2A shows the major rail and marine transportation network in Canada today. This consists essentially of the transcontinental main lines of CP Rail and CNR which, with major connecting lines, comprise some 12,000 miles, of which about 2,100 miles are double tracked. The major double tracked segments are in the Quebec-Windsor corridor and between Winnipeg and Thunder Bay for both railways, with CP having additional double track segments on the Prairies and for about 100 miles of the mountain link from Golden to Vancouver. Major ports are Vancouver, Roberts Bank and Prince Rupert on the west coast; Churchill on Hudson Bay; Thunder Bay, Toronto and Hamilton on the Great Lakes; Montreal, Quebec, Trois Rivières and Sept Isles on the St. Lawrence; and Halifax and Saint John on the east coast. The major canal links are the St. Lawrence Seaway, connecting Lake Ontario to the St. Lawrence River, the Welland Canal between Lake Ontario and Lake Erie, and the Sault Ste. Marie Canal, on the American side, connecting Lake Huron and Lake Superior, and the Canadian Sault Ste. Marie Canal though the bulk of the tonnage goes through the American locks.

The primary highway network is illustrated in Exhibit 2B. It comprises some 17,000 miles of major highways which were jointly defined by the Provinces and the federal Government during the


Great Slave
BCR
Northern
Alberta
CN
Ontario
Northland
QNS & L.
QC
EXISTING MAJOR RAIL LINES
AND MARINE ROUTES.
CN
CP
Northern Extentions
Lakes


EXISTING PRIMARY HIGHWAYS
Trans Canada
Other Primary
Northern Extensions

Highway Systems in Canada Study (1972) as being of national significance. In accordance with the British North Amercia Act, these highways fall under the jurisdiction of the provinces within which they lie. The map shows the Trans Canada Highway, which was completed in 1962 with federal assistance. The completion of highway sections in British Columbia and Northern Ontario in the early 1960's allowed, for the first time, an all-Canadian motor link from Victoria to St. John's.

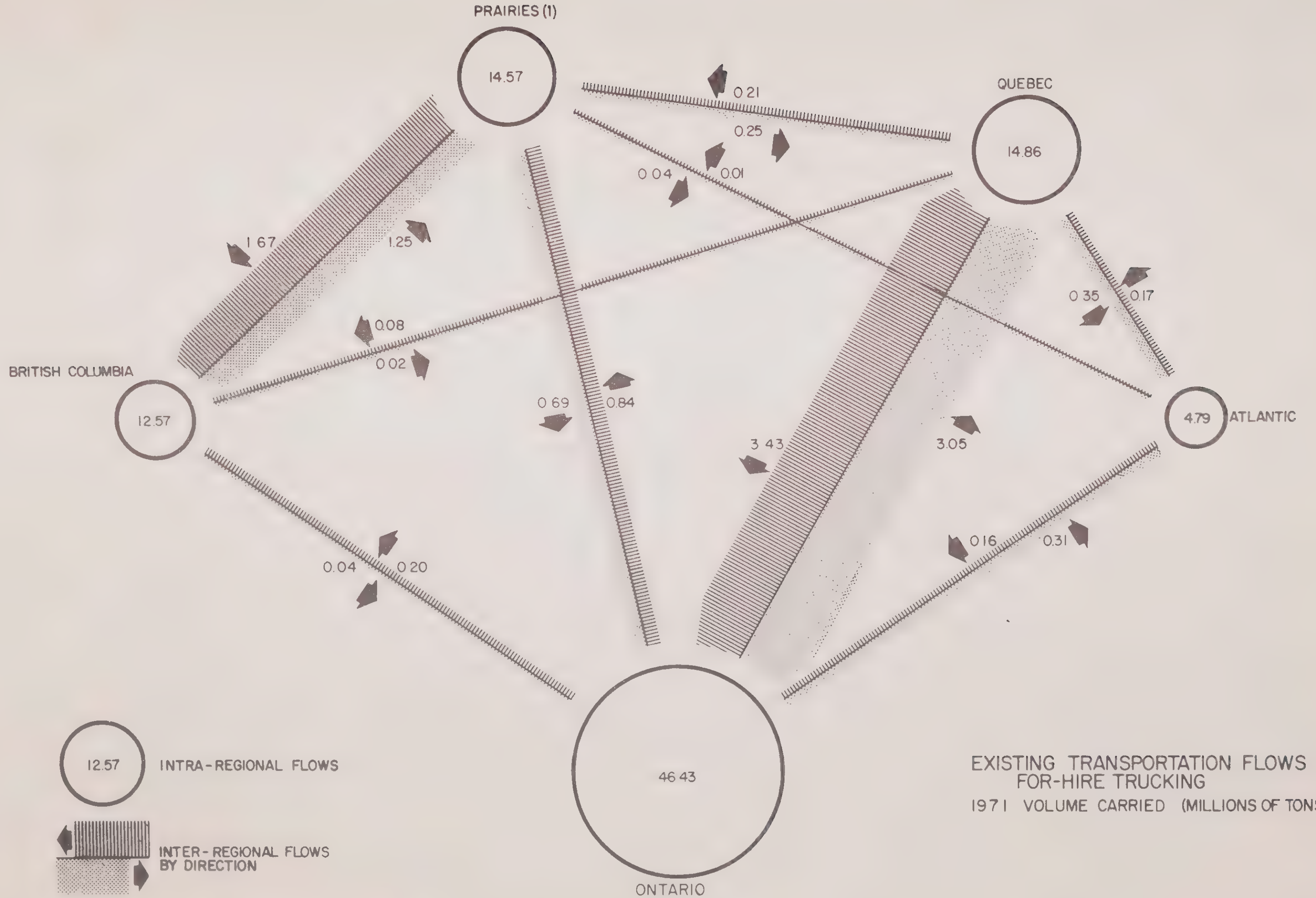
We have referred earlier to air freight traffic. Owing to the relatively small tonnages carried by this mode and the fact that they are carried primarily in passenger aircraft, we do not deal further with air freight in this summary report. Air terminals for passenger travel are dealt with in the interim report on Passenger Transportation, a companion volume to this Freight Transportation report.

Freight Volumes

Exhibit 3A illustrates the freight volumes carried by the rail network in 1972. Tonnages carried in each direction on major rail lines are shown, emphasizing the heavy flows both westbound and eastbound from the prairie region. Figure 3B shows volumes carried between selected regions by truck in 1972.

In general, the rail/marine systems carry bulk commodities including grain, iron ore, coal, forest products, potash and sulphur, over long distances from their origins in Western Canada and in northern areas of Ontario, Quebec and Labrador to east and west coast ports, mostly for export. The truck mode, on the other hand, is used predominantly for general cargo and for local bulk haulage, such as

EXISTING TRANSPORTATION FLOWS: RAIL



EXISTING TRANSPORTATION FLOWS
FOR-HIRE TRUCKING
1971 VOLUME CARRIED (MILLIONS OF TONS)

NOTE 1: PRAIRIE REGION INCLUDES YUKON AND NORTH WEST TERRITORIES

sand, gravel and cement. The average length of haul for rail is slightly under 600 miles, while that for truck is less than 150 miles. These figures are summarized in Exhibit 4, which shows the approximate net tonnages for major commodities carried by the various facilities and modes in Canada. While it must be emphasized that these figures, particularly for trucking, are quite approximate owing to the lack of detailed surveys, this table provides a rough indication of the market share carried by the two ground transportation modes: of the approximately 400 million tons per year carried by rail and truck combined, rail carried about 225 million tons and truck (for hire trucking and private trucking combined) carried about 175 million tons, giving rail about 56 per cent and truck about 44 per cent of the tons carried. As pointed out earlier, the average rail haul is about four times longer than the average truck haul, so that the market share in terms of ton miles is much more in favour of the rail mode. On the other hand, the average revenue per ton mile for trucking is estimated to be four or five times that for rail (owing to the shorter hauls, smaller shipments and preponderance of general cargo), such that the annual revenues to for hire trucking companies exceeds that to the railways, being $2.23 billion in 1972 for the hire trucking industry versus $2.03 billion for the rail industry.

Exhibit 5 shows the growth in annual tonnages produced during the past 20 years, by commodity. In general, the rate of growth of rail freight tonnage in Canada has averaged about 1.5-2.0% annually while ton miles have grown at 3.5-4.0% annually due to increases in the

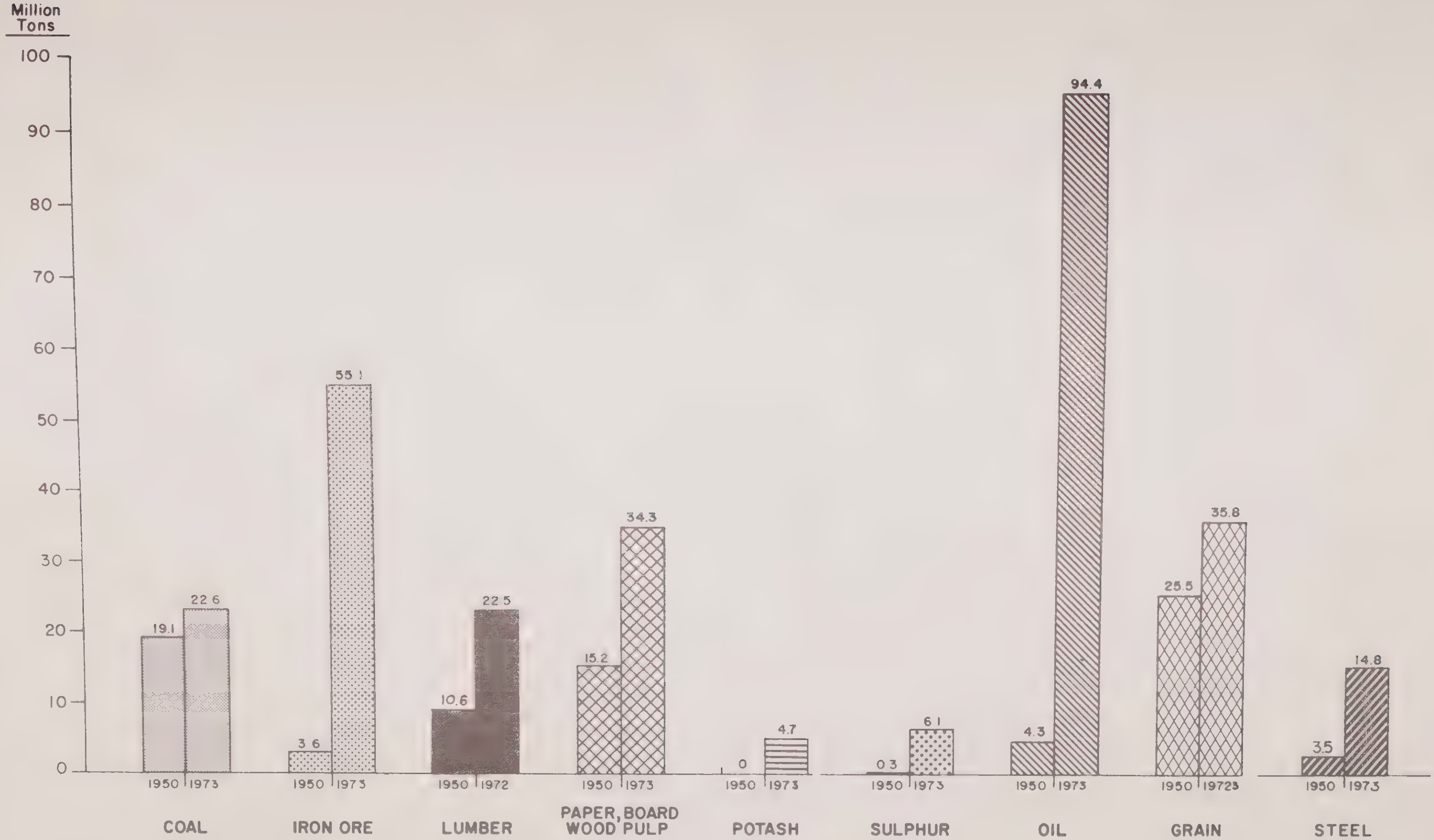
EXHIBIT 4

NET TONS CARRIED BY MAJOR FACILITIES/MODES: RECENT
(Millions of Short Tons)

Facility/Mode Commodity	Rail (1972)	West Coast Ports (1971)	Lakes Ports (1971)	Welland Canal** (1971)	St. Lawrence Seaway** (1971)	East Coast Ports (1971)	For Hire Trucking† (1972)	Private Trucking† (1972)
All Grains	34.6	7.6	13.3*	23.8	22.6	10.2		
Iron Ore	45.8	1.2	6.7	13.6	13.4	43.3		
Coal	15.0	6.1	16.7	9.7	0.8	0.3		N/A
Potash and Sulphur	13.2	4.0						
Forest Products	19.2	3.6	0.3			1.9	6.2	N/A
All Other Bulk	70.1	2.6	0.8			10.8	38.0	N/A
General Cargo	27.5	6.6	5.1	15.8***	16.1***	11.7	64.8	N/A
TOTAL	225.4	31.7	42.9	62.9	52.9	78.2	109.0	63.0

* Includes 0.7 via the Port of Churchill, Manitoba
** Includes traffic originating both in Canada and the U.S.
*** Includes other bulk as well as general cargo
† Extimates for intercity carriage; excludes urban trucking.

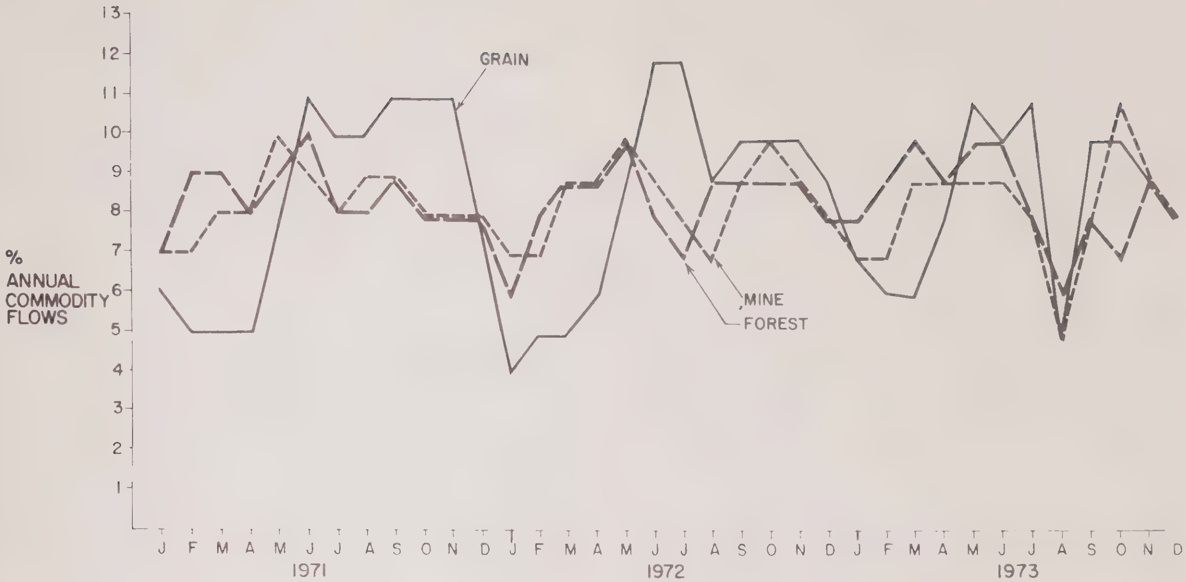
In addition, crude oil and natural gas pipelines in Canada generated over 90 billion ton miles.



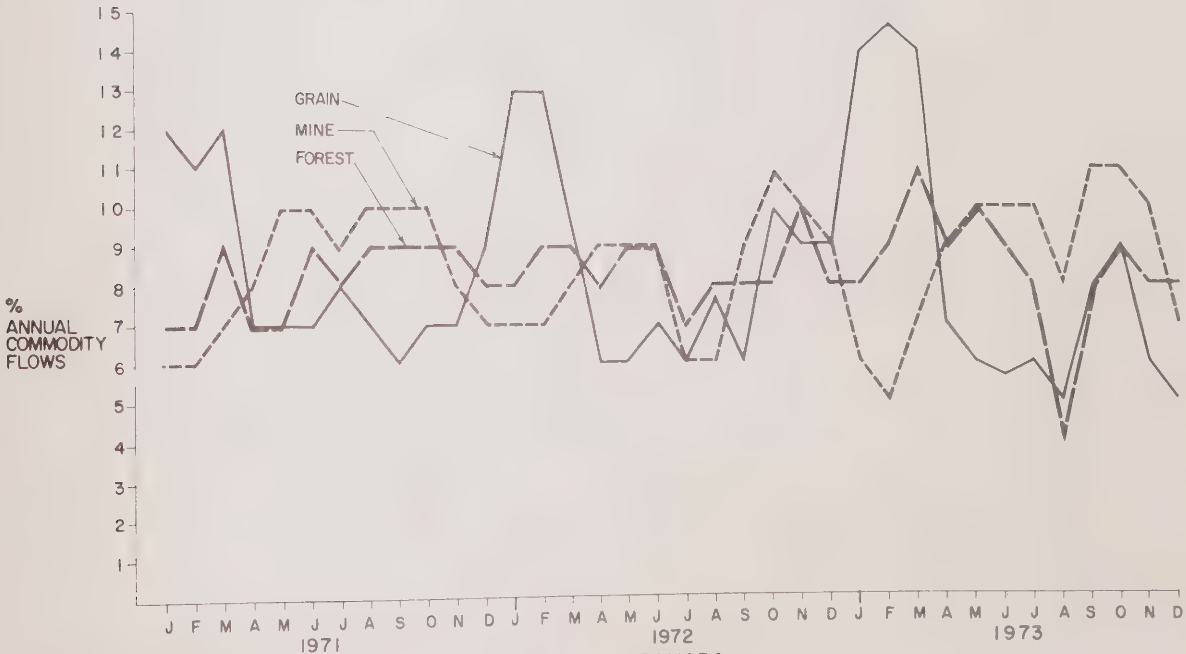
PAST TRENDS IN COMMODITY PRODUCTION 1950 - 1972 / 3

length of haul. It should be noted, however, that the rate of growth of certain bulk commodity shipments has greatly increased recently, in particular iron ore, coal, forest products, sulphur and potash, such that the railways have been experiencing more rapid increases in ton miles (about 6.5%) per annum compounded during the past five years owing to longer hauls on bulk shipments. Shipments of iron ore from northern Quebec and Labrador have, for example, doubled from 21.3 million tons in 1963 to 41.2 million tons in 1973, and are expected to double again to 84.8 million tons by 1985. As is discussed in more detail in later sections, it is of critical importance to transportation policy to determine whether these rates of growth can and should be maintained and, if so, how best to provide the necessary transportation capacity.

Another characteristic of prime importance in transportation is peaking: that is, the manner in which shipments tend to fluctuate up and down during a typical year, season, month, week or day. Exhibit 6 provides information on average monthly fluctuations of bulk commodity shipments by rail eastbound and westbound for major commodities, based on data for the years 1971, 1972 and 1973. Grain and agricultural volumes in the west show peaks in the summer and fall months, livestock in the fall months, fertilizer (potash) in the spring and fall, with other products displaying a more constant flow rate throughout the year. The winter peaks of grain in the east reflect closing of the Great Lakes system and diversion of grain shipments to rail. These fluctuations are reflected in Exhibit 7 which shows the seasonality of rail shipments and movements through the St. Lawrence Seaway and Welland Canal in 1973 and 1974. In general, the winter months, December, January and February, represent

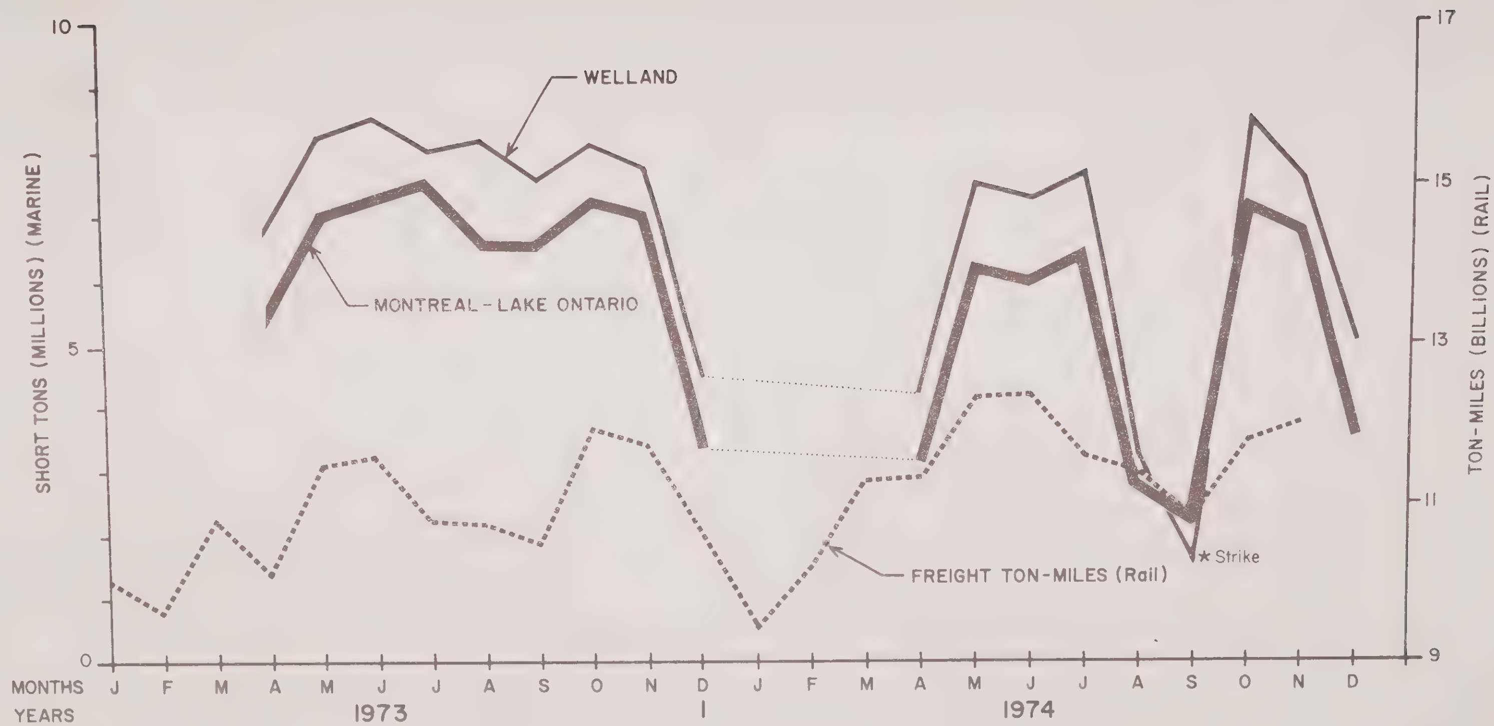


WESTERN CANADA



EASTERN CANADA

SEASONALITY OF COMMODITY FLOWS



SEASONALITY OF FLOW
RAIL AND MARINE VOLUMES

the low point for both modes. Climatic conditions are important in this regard, in particular for the canals which are closed between December and March; a lengthening of the shipping season by as little as one or two weeks can have a significant effect on the capacity of this mode. Major fluctuations are also caused by labour interruptions, as illustrated for the canals in Exhibit 7.

Container traffic has grown rapidly as a means of transporting general cargo, particularly for goods imported into Canada via eastern seaports. The shipment of truck trailers on rail flatcars has also shown substantial growth, as a means of reducing operating costs for the line haul while retaining flexibility for pick-up and delivery via the truck mode. Container traffic in Canada has risen from 0.5 million tons in 1969 to 3.9 million tons in 1973. Piggyback traffic (trailer on flatcar) has risen from 3.2 to 4.1 million tons per year during the same period.

Capacity Limitations

The concept of capacity - the number of tons or number of vehicles of various types which can pass through a transportation facility in a given period of time - is important as a basis for determining the nature, extent and timing of capital investments to increase the ability of transport facilities to carry traffic. For all of the modes covered in this analysis - rail, marine, truck - the concept is complicated by a number of factors, the most important of which are: mix of traffic/vehicles, size of vehicles, level of services, and peaking. For example, the practical capacity of a transportation facility will be less if a number of slow vehicles impede the passage of faster ones, if small vehicles are used which use infrastructure inefficiently, and if traffic peaking is such that the facility is relatively unused for much of

the time. Conversely, the capacity of a facility will be considerably higher if all vehicles have weight/power characteristics which allow them to move at the same speed, if large vehicles are employed which utilize the entire size/weight capability of the infrastructure, and if a constant flow can be maintained for this facility on an hourly, daily, weekly and monthly basis.

The capacity of a facility is also substantially affected by the signalling system and the manner in which it is operated. A single rail line may be able to carry up to 20 - 25 trains per day with block signalling and train order control methods, but would be able to handle up to 35 - 40 trains per day under central traffic control. A double track rail line, with a few cross-overs between the two tracks to allow for track maintenance, might carry up to 45 - 50 trains per day, while a double track line with many cross-overs could carry in excess of 60 - 70 trains per day. Similarly, the Welland Canal was experiencing capacity difficulties in the early 1960's while carrying 50 million tons per year of traffic; improved signalling and lockage procedures, coupled with pricing incentives for the use of larger, more productive ships, raised the capacity by an estimated 50%. It is a well-known fact that road capacities are much increased if signalized intersections are replaced with grade separated, controlled-access facilities.

Further limitations on capacity may be experienced because of maintenance requirements. For example, rail track has an estimated life of about 200 million gross ton miles (GTM's) per mile of track. This means that if the track is carrying 50 million GTM's per year (which, depending on the type of commodities and trains using the track, might

represent about 25 - 30 million net tons carried, in both directions, on the line) the rail would have to be replaced, on average, about once every four years. More frequent replacement becomes very costly and can be a real limitation on capacity, unless the line is double tracked with a large number of cross-overs.

In summary, capacity is affected by both the supply aspects of the facility (its physical characteristics) and its demand profile (peaking, vehicle mix). The achievable flow rate depends on both, and may be increased at the expense of level of service, for example by making some users wait, thereby effectively smoothing peak demands.

Clearly, the capacity of a given transportation facility can vary by a factor of two or more, depending upon combinations of the above factors which are experienced. Nevertheless, it is possible to apply some "rules of thumb" as a basis for broad policy planning. For example, based on the mix of traffic (unit trains, fast freights, slow freights, passenger trains) presently experienced, it can be expected that mainline rail links, single track with centralized traffic control, will have a capacity limitation of about 30 - 40 trains per day in both directions. As shown later in Exhibit 22, both CN and CP were experiencing loads in the range 25 - 35 trains per day on links west of Edmonton and Calagary and between Saskatoon and Thunder Bay in 1972. Since traffic has continued to grow rapidly on these links, it is likely that they are approaching their present capacity such that operational changes and/or construction of more sidings or double tracking will be required to cope with further increases in traffic. These links are highlighted in Exhibit 22. Similarly, the capacity of

the Welland Canal and the Seaway between Lake Ontario and the St. Lawrence River is estimated to be about 90 million net tons per year based upon current operating procedures and the type of lakers (about 25,000 tons) now using these facilities. Since volumes through the Welland Canal were 67 million tons in 1973 and 52 million tons in 1974 and the Seaway carried 58 million tons in 1973 and 44 million tons in 1974, these facilities are not considered to be capacity limited at the present time.

The estimated present capacity of relevant Canadian ports for iron ore is about 90 million tons, of which 76 million tons capacity is at the three north shore Quebec ports of Sept Isles, Pointe Noire and Port Cartier; the volume handled in 1974 was about 42 million tons, such that there is substantial capacity for increased growth at this time. The estimated present capacity of Canadian ports for coal is 48 million tons versus a 1974 volume of 25 million tons. Other port figures are a capacity of 41 million tons for grain versus 36 million tons carried in 1971 and a capacity of 32 million tons for general cargo (including containers) versus 23 million tons carried in 1971. Similar volume/capacity ratios apply, in general, at the individual ports, although Vancouver port traffic has suffered delays due to space limitations, and an obsolete grain handling system, and strikes have caused delays at both Vancouver and Montreal. In summary, therefore, it can be said that while the marine mode has spare capacity at present, the rail mode is approaching capacity limitations in the western mountain region and/or certain Prairie links and links leading from Winnipeg to Thunder Bay.

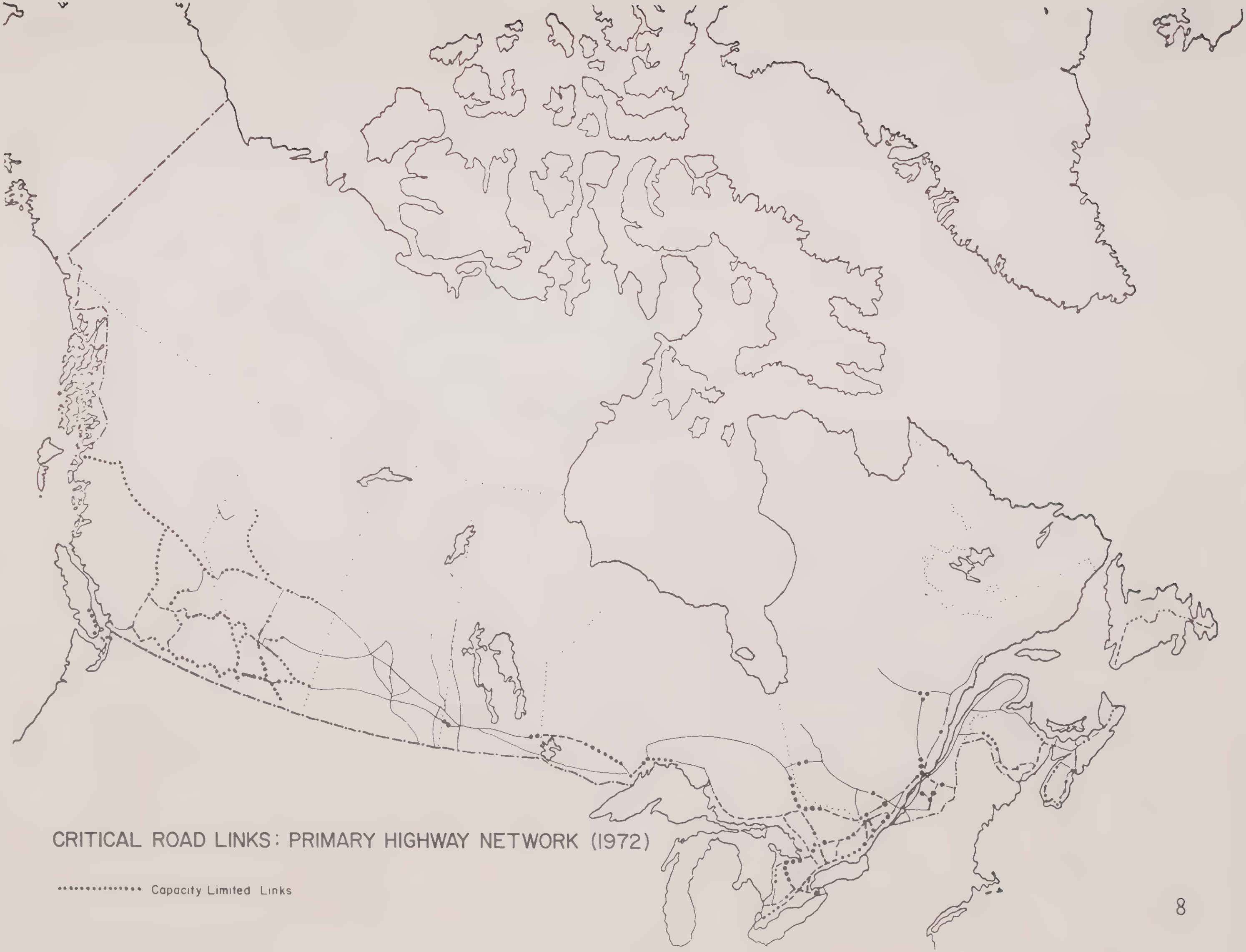
Exhibit 8 shows primary highway links estimated to be suffering from capacity limitations under certain peak conditions (30th highest hour in the year) in 1972. It must be pointed out that private automobiles are the primary users of highway capacity and that automobile flows are highly peaked for work trips and weekend recreational trips close to large urban centres and during the summer months, particularly on peak summer weekends, in the vicinity of major recreational areas. In the absence of private automobile traffic, the primary highway system's capacity for truck traffic would be practically infinite relative to the level of freight loads which might be placed on it. Given that private automobile traffic exists and continues to grow, truck traffic suffers capacity limitations and congestion costs on the links shown in Exhibit 8.

Ownership, Management and Competition

Freight transportation in Canada is provided by a mixture of private and public enterprise. In general, government owns and operates highways, airports and marine transport infrastructure, while commercial public and private enterprises (including CN and Air Canada in this category) own and operate rail infrastructure and rolling stock, ships, trucks, aircraft and truck terminals. The identity of the major public and private operators, their assets, productivity and levels of competition are discussed briefly in this subsection.

Transportation Agencies and Operators

The Federal Government has been involved in transportation, in a variety of ways, since Confederation. Initially, federal concern was with the construction of transportation infrastructure in a country whose sparse population was separated by great distances; public ownership and



CRITICAL ROAD LINKS: PRIMARY HIGHWAY NETWORK (1972)

·············· Capacity Limited Links

investment are still basic to all modes except rail and pipeline. As each mode evolved, the federal government's role became increasingly that of a regulator concerned with safety standards, subsidies, pollution control, control of entry and price control. The federal government exercises controls by federal-provincial cooperation and through the federal Ministry of Transport, which provides technical regulation by the Air, Marine, Surface and Arctic Transportation Administrations; economic research and regulation and railway safety rules are exercised by the Canadian Transport Commission; technical research is provided by the Transportation Development Agency; and policy direction is provided by the Ministry Headquarters.

The Canadian Transport Commission was established by the National Transportation Act (NTA) in 1967. To existing rail, air and maritime regulatory boards (now committees) were added highway and commodity pipline transport committees. As well as regulations and safety, the CTC is responsible for policies compatible with the requirements of the NTA and for research and studies concerned with determining how coordination in the development and regulation of the various modes of transport can be achieved.

The Northern Transportation Company Limited (NTCL) provides a general transportation system for the movement of goods in the Mackenzie Basin and Arctic Coast areas. The company operates tugs, barges and motor vehicles and provides warehousing and docking facilities. It owns about 200 vessels and its undepreciated assets in 1974 were about $92 million.

The National Harbours Board (NHB) provides facilities for the berthing of vessels and for the handling and protection of waterborne transit cargo and promotes the utilization of national harbours. It owns and operates harbour facilities, including shipping lanes, wharfs, piers, grain elevators, warehouses, container and bulk handling facilities, roadways, railway tracks, etc. in fifteen ports which are designated as national harbours. The major ports include Vancouver, Prince Rupert, Churchill, Montreal, Quebec, Chicoutimi, Sept Isles, Halifax, Saint John and St. John's. Its undepreciated assets in 1973 were worth $590 million. For comparison assets in 1972 of Commission harbours (including Thunder Bay, Toronto, Hamilton and Fraser River) were $123 million, 1972 assets in government wharves were $600 million, and assets of private harbours (including Port Cartier, Pointe Noire and the eastern oil ports) are estimated to exceed those for all public harbours.

The St. Lawrence Seaway Authority (SLSA) was incorporated for the purpose of constructing, maintaining and operating the works comprising the Canadian portion of a deep waterway between the Port of Montreal and Lake Erie. The SLSA Act provides for reasonable charges to users designed to defray costs including interest on loans. The level of tolls is set by a Canada-U.S. agreement which provides for review at the request of either country. The waterway is divided into two sections: the Montreal-Lake Ontario section comprises seven locks and approaches, five of which are located in Canada, and operated by SLSA; the Welland Canal section comprises eight locks, all of which are in Canada and operated by SLSA. The undepreciated assets of SLSA in 1973 were about $818 million.

The Provinces (and municipalities, since constitutionally they are creations of the provinces) are involved in transportation mainly in

highway transport and to a lesser extent in railway transport. Provincial authorities have jurisdiction over freeways and highways and are responsible for the licencing of private passenger and commercial vehicles. Regulations involve the control of entry in for hire truck and bus transport and the control of related tariffs. Provinces also have jurisdiction over potential intra-provincial commodity pipeline transport.

The railway industry comprises some 30 railways throughout Canada, of which the major ones include Canadian National Railways, CP Rail, British Columbia Railway, White Pass and Yukon, Ontario Northland, Quebec North Shore and Labrador Railway Company, Quebec Cartier Railway, Algoma Central Railway, Alberta Resources Railway and Great Slave Lake Railway (both operated by CN) and Northern Alberta Railways (jointly owned by CN and CP).

Canadian National Railways (CNR) was created in 1923 to ensure the continued operation of a number of financially-troubled railway companies so that adequate rail service could be continued throughout the settled portion of the country. The CNR has been required to be more responsive to public policy than would be the case for a private commercial carrier, while at the same time servicing a massive debt inherited from its component companies. The present role of the CNR is seen as that of a commercially-oriented enterprise responding to the marketplace, but with an additional responsibility to respond to the transportation implications of broader national purpose. CN operates some 6,700 miles of mainline track, with a current fleet of about 2,100 locomotives and 107,000 rail cars. As of Dec. 31, 1973, it had an investment in fixed plant of about $3 billion and in equipment of about $1.4 billion.

Canadian Pacific Railway is a privately-owned company whose role in partnership with the Government of Canada in providing a transportation network in the early days of Confederation is well

documented. Like many transportation companies, CP Rail is now part of a conglomerate with Canadian Pacific Limited as the parent company. Canadian Pacific has interests in almost all aspects of the Canadian economy, including rail, air, trucking, pipeline and marine transportation and oil, gas, mining, forest products, hotels and real estate, all stemming from the company's involvement in transportation. It operates about 5,100 miles of mainline track with a current fleet of about 1,200 locomotives and 73,000 freight cars. As of December 31, 1973, it had a gross investment of about $1.6 billion in fixed plant and $1.1 billion in equipment.

The other major railways listed above operate some 1,424 miles of main line in British Columbia, 896 miles in Alberta and the Northwest Territories, 1,472 miles in Ontario and 733 miles in Quebec-Labrador. They operate approximately 418 locomotives and 15,000 rail cars and have undepreciated 1973 assets of approximately $1 billion in rail properties.

The Canadian marine transportation industry has traditionally had close ties with the ship-building industry and to a great extent the economic benefits from the two industries are intertwined. Vessels comprising the Canadian flag fleet are primarily inland: lakers, river barges and tugs. The Canadian laker fleet currently comprises about 200 vessels with a gross tonnage of about 1.8 million tons, representing an investment of about $1 billion. The Canadian deep-sea fleet is small and Canadian shipping companies often use flag-of-convenience registration. Access to ships of ship-owning countries is provided by over 40 shipping agents representing about 80 steamship lines. Canada's ocean-going merchant fleet consists of four dry cargo vessels and one tanker for a total gross tonnage of about 24,000 tons.

The coastwise trading fleet consists of 76 Atlantic coast vessels (314,000 tons) and 34 Pacific coast vessels (131,000 tons). It is the policy of the Government of Canada that only Canadian registered ships may be used in the carriage of goods between Canadian ports.

The trucking industry consists of thousands of individual enterprises owned by individuals, coporate users, railway companies, etc. Of the one million trucks registered in Canada, about 6% are in the "for hire" category which carried about 45% (in tons) of the 1972 intercity freight traffic carried by rail and for hire truckers and earned about 57% of the freight revenues to these carriers. About 40% of the value of Canadian exports to the U.S. are estimated to move by truck.

Exhibit 9 shows the estimated net capital stock in terms of infrastructure and equipment by mode. The total stock as of 1970 by mode was as follows:

- air	$1.2 billion
- water	3.5 billion
- rail	4.5 billion
- highway	11.0 billion
Total	$20.2 billion

Productivity

Major increases in productivity have been achieved over the past decades by the introduction of more efficient propulsion units (rail dieselization, jet aircraft), larger vehicles (100-ton hoppers, 25,000-ton lakers, jumbo jets, larger, multiple-trailer trucks), improved handling (unit trains, containers, piggyback operations, etc.) and more productive equipment in general. An

EXHIBIT 9

NET CAPITAL STOCK BY TRANSPORTATION MODE

(in 1968 million dollars)

	1960			1970		
	Infra-structure**	Equip-ment***	Total	Infra-structure**	Equip-ment***	Total
Air	420	284	704	560	637	1,197
Water	2,440	927	3,367	2,490	1,037	3,527
Rail	2,730	1,926	4,656	2,590	1,880	4,470
Highway*	5,020	202	5,222	10,600	357	10,957
total	10,610	3,339	13,949	16,240	3,911	20,151

* Infrastructure includes urban as well as inter-urban and rural highways;
Equipment includes all for hire "trucks and buses, and excludes "private" trucks.

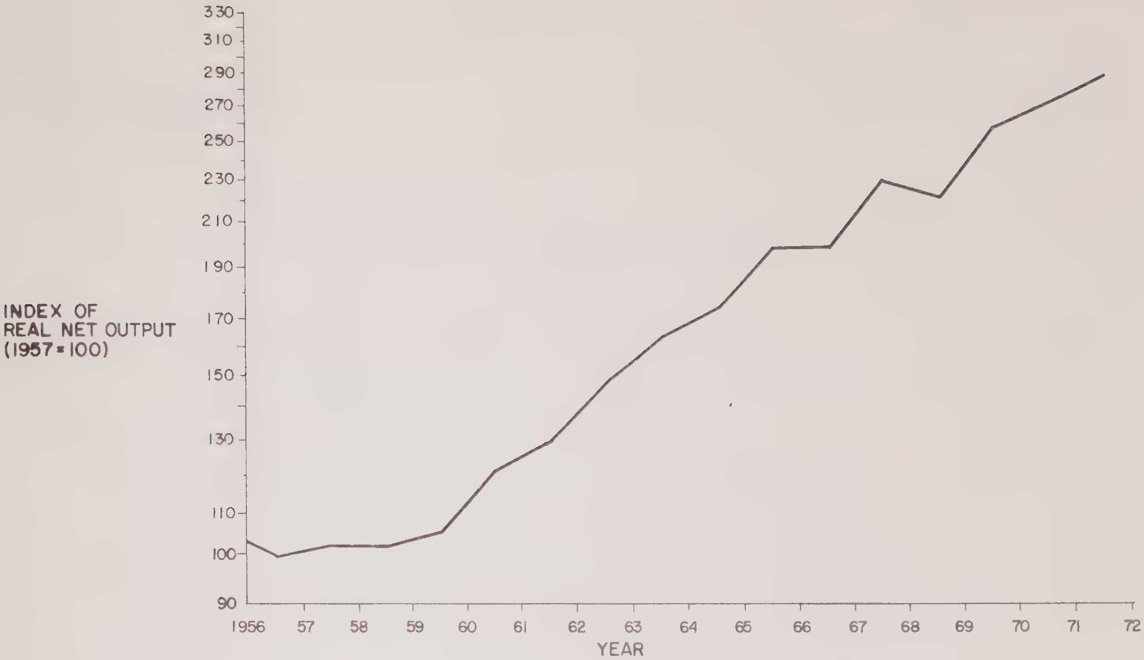
** Source: Transport costs and revenues in Canada, by Z. Haritos, Journal of Transport Economics and Policy, Jan. 1975.

*** Source: Fixed Capital Flows and Stocks, 1926-1973, Statistics Canada 13-211.

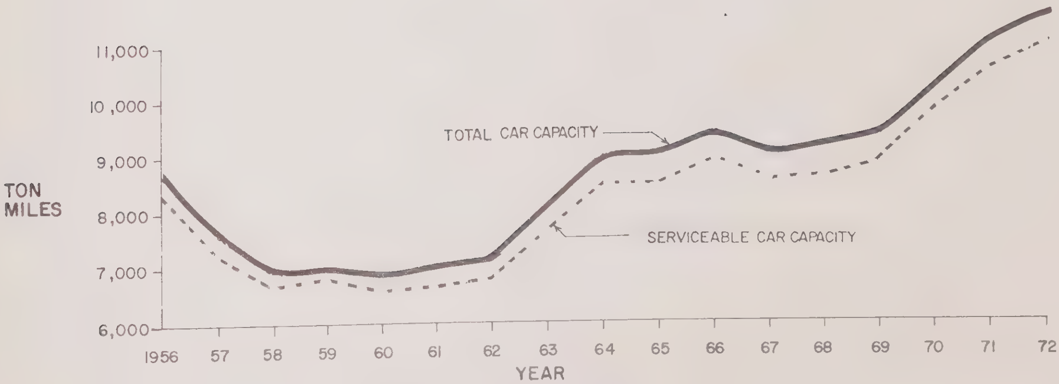
example of these developments is illustrated in Exhibit 10, which shows how rail productivity has been improved in terms of various factors of production.

As indicated, we can expect some future continuing gains in productivity, particularly with the introduction of more unit trains, more containerization and piggyback operations, more widespread use of large ships, rail cars and trucks, by the possible introduction of rail electrification and other means of increasing motive power, and related technological developments. It is calculated, for example, that the railways will continue to increase their productivity, measured in terms of ton miles per constant dollar of operating expenditure, at the rate of about 2.25% per annum. It is clear, however, that vehicle size and weight limitations are being approached for the rail and highway modes and for the St. Lawrence Seaway canals unless longer locks are constructed which would accomodate the 1,000 foot lakers which are now used on the upper lakes. These limitations will mean that effective increases in capacity, for given infrastructure, will no longer be achieved as easily as they were during the past few decades by using larger vehicles. Increasing levels of investment in expanded infrastructure may therefore be expected, particularly in the rail mode, which has been operating with excess line haul capacity for many decades but which is now coming up against capacity limitations, as outlined earlier.

The other major implication of lessening rates of productivity increase is that a major means of stablizing transportation costs and therefore rates will no longer be as effective in this regard. Rates can thus be expected to rise, in future, more in line with the general cost of living, rather than lagging behind the cost of living as has been the case during the past few decades.



INDEX OF REAL NET OUTPUT PER PERSON EMPLOYED



TON MILES PER TON OF FREIGHT CAR CAPACITY

IMPROVEMENTS IN PRODUCTIVITY ON CANADIAN RAILWAYS

Competition

Three types of actual or potential competition are relevant:

- intra-modal competition, which exists where more than one carrier provides identical or similar service in a specific transport market,
- inter-modal competition, which exists where carriers of two or more different transport modes compete in the same or related markets, and
- market competition, which exists where the elasticity of demand for transport is high, even in the absence of direct competition between transport carriers or modes, because of key competition between the producers of the goods to be transported or between the distribution centres for these goods.

There is evidence that considerable intra-modal competition exists in the trucking mode (see figure 12 in the following sub-section, which shows that several major trucking firms serve virtually all important inter-city pairs in Canada) and the same appears to be true among shipping firms serving the Great Lakes and our coastal trade. Competitive forces acting on the rail mode appear to be largely of the inter-modal and market types.

There is some evidence that these forces have had an impact on rail rates. As shown in Exhibit 11, the proportion of rail traffic moving under competitive rates and agreed charges (that is, in which rail rates have been set in response to competitive forces) has increased substantially between 1957 and 1972 for all major traffic flows in Canada. During the period 1963 to 1973, the average rail revenue per ton mile, including statutory rates, increased only from 1.40¢ to 1.50¢ This would appear to reflect not only the above competitive pressures, but the loss of higher revenue general cargo traffic to trucking, a rapid increase in volumes of bulk commodities carried, and significant increases in the productivity of bulk commodity carriage, as noted in an earlier section.

EXHIBIT 11

COMPETITIVE RATES AND AGREED CHARGES AS % OF TOTAL TRAFFIC REVENUES (R) AND TON-MILES (T)

REGION OF	1957		1966		1971		1972	
ORIGIN & DESTINATION	R	T	R	T	R	T	R	T
Maritimes to Maritimes	31.1	29.2	55.9	59.5	63.3	64.6	65.5	65.0
Maritimes to Eastern	30.9	28.9	54.4	51.5	70.0	78.9	82.2	76.6
Maritimes to Western	18.7	24.2	35.0	36.2	75.6	78.6	84.0	82.0
Eastern to Maritimes	20.0	12.1	45.9	35.3	62.4	61.2	63.3	58.4
Eastern to Eastern	44.8	46.7	73.4	72.3	80.2	78.9	80.8	76.6
Eastern to Western	53.6	58.1	67.2	72.1	87.1	91.0	89.6	92.5
Western to Maritimes	34.8	41.5	38.0	45.8	79.3	75.6	76.4	66.2
Western to Eastern	47.6	56.1	59.8	56.8	72.4	66.5	69.3	63.5
Western to Western	27.9	20.9	57.2	43.1	41.6	27.2	43.1	26.6

In general, a large number of independent trucking companies in Canada (estimated in the range of 14,000 - 20,000, of which about 2,000 were defined by the 1972 Statistics Canada "Data Sheet" as large firms) provides effective intra-modal competition in this mode. Rail-truck competition also exists for general cargo, including container and piggyback traffic, in most parts of Canada, although domestic container traffic growth has been relatively slow. For bulk commodities, marine-rail competition is effective from Thunder Bay for most important flows. While bulk shippers are captive to the railways throughout Western Canada, market competition appears to have influenced bulk rates in some cases.

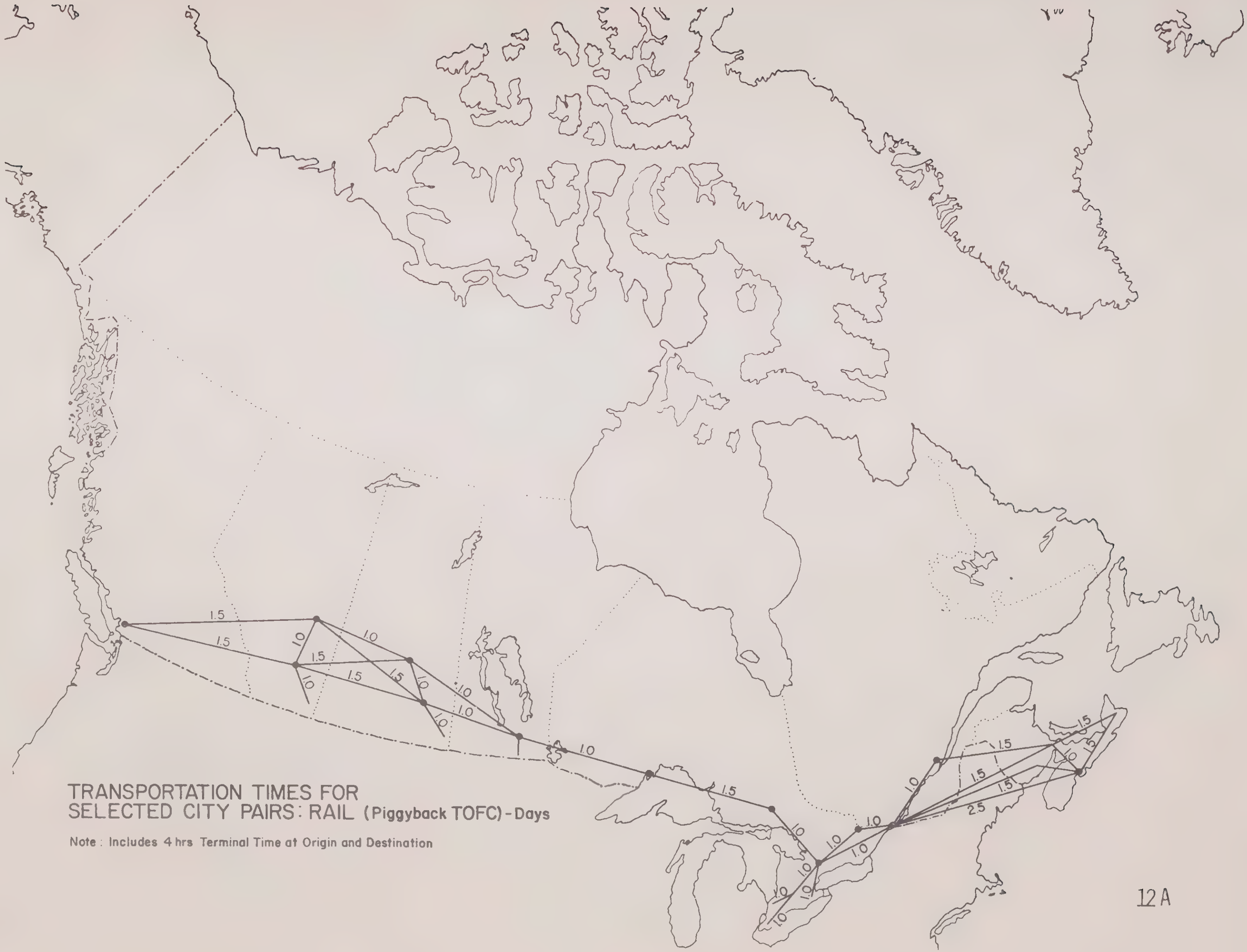
Accessibility and Equity

Trucking services are relatively ubiquitous throughout Canada, rail services somewhat less so, but still nationwide, and marine transportation is available only in coastal areas abutting the Great Lakes and other major waterways.

In assessing Canadian transportation policy, it is necessary to consider the level of service provided to Canadians for different purposes in different parts of the country and the prices (rates) which are charged for these services. These questions are discussed briefly in this subsection with regard to freight transportation in Canada.

Level of Service

Exhibit 12 shows rail and truck transit times and, for truck, the number of major carriers competing for general cargo carriage between



TRANSPORTATION TIMES FOR
SELECTED CITY PAIRS: RAIL (Piggyback TOFC) - Days

Note: Includes 4 hrs Terminal Time at Origin and Destination

TRANSPORTATION TIMES FOR
SELECTED CITY PAIRS: TRUCK
(DAYS)

2 Carriers only
3-4 Carriers
5 + Carriers

Note Unmarked Links all "Overnight" Service

major city pairs in Canada. It can be seen that, in general, overnight trucking services are provided for city pairs within each region, and rail transit times are generally comparable for container and piggyback service. The frequency of service, another measure of service quality, is generally daily for both rail and truck for major city pairs and somewhat less frequent, particularly via rail, for city pairs with less traffic density.

Another major measure of service quality, reliability, can be measured in terms of service delays, breakage, loss, and major interruptions in service owing to strikes or system breakdowns. Loss, breakage and delays have traditionally been worse for rail break-bulk general cargo traffic than for carriage by truck, and this would still appear to be the case. Great improvements in reliability have been achieved in the rail mode with the advent of containers and piggyback operations. However delays in shipment still appear to be more frequent by rail than by truck, and the rail and marine modes have been much more susceptible to strike interruptions (many beyond the control of the railroads) particularly affecting bulk commodities such as grain.

Rates

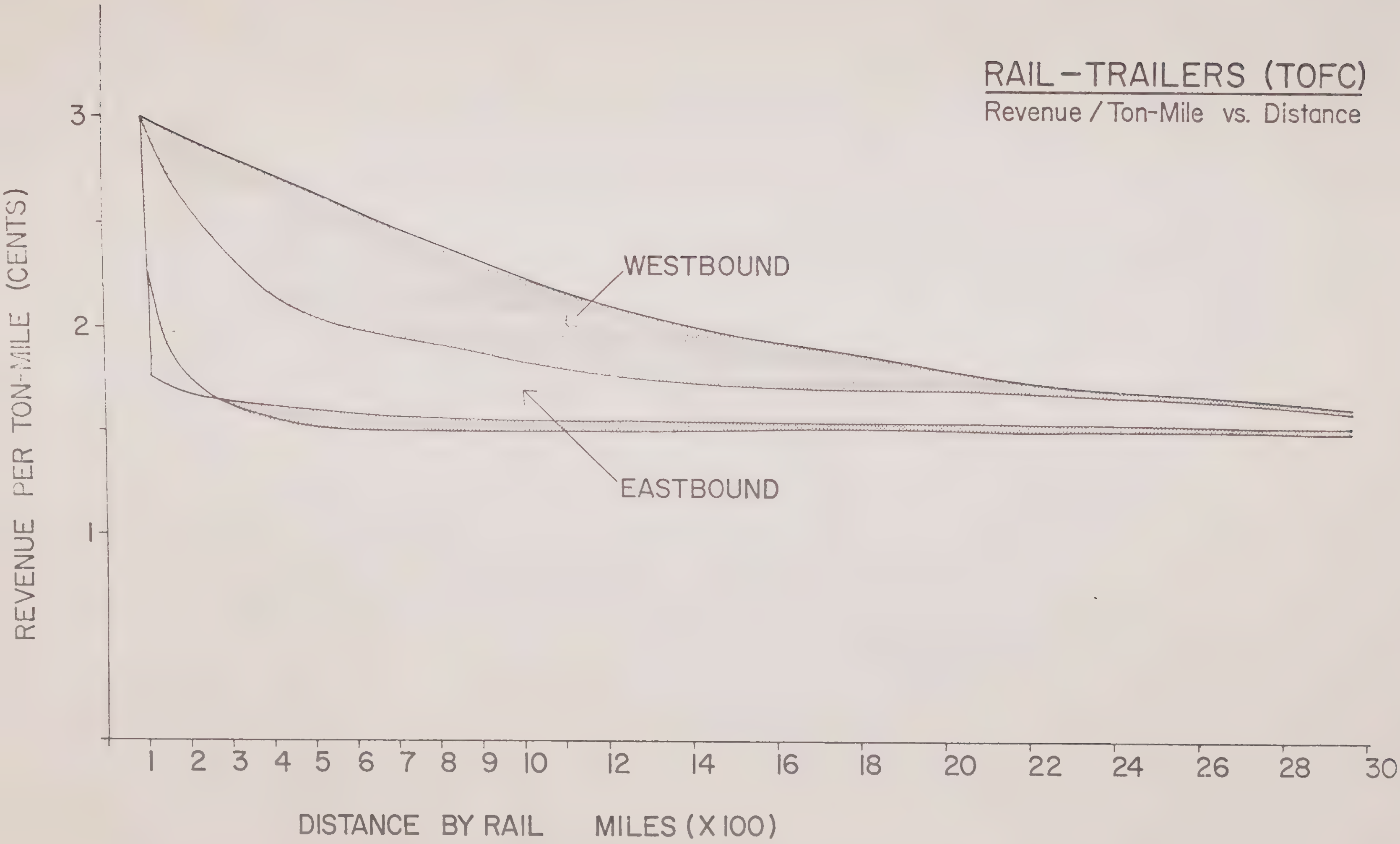
There has been much controversy regarding inequities in rail rates, particularly in Western and Atlantic Canada. Detailed studies have been carried out as part of the work undertaken subsequent to the Western Economic Opportunities Conference. Some anomalies were identified in terms of length of haul and processed versus unprocessed goods. An active program is underway to deal with these and related freight rate problems, with a view to reducing the sense of unfairness that they create. While it

was not possible in the time available to carry out an exhaustive analysis of all rates, a sample of rail and truck rates was assembled for various types of general cargo between major Canadian city pairs. Exhibit 13 summarizes one result of this analysis, showing the variation of general cargo truck and rail rates with distance. A comparison of intra regional truck-load rates with trailer-on-flat-car rail rates for general cargo shows that the rail rates are generally much lower than truck rates in all regions, as would be expected owing to the generally superior door-to-door service provided by truck and the higher operating costs of this mode.

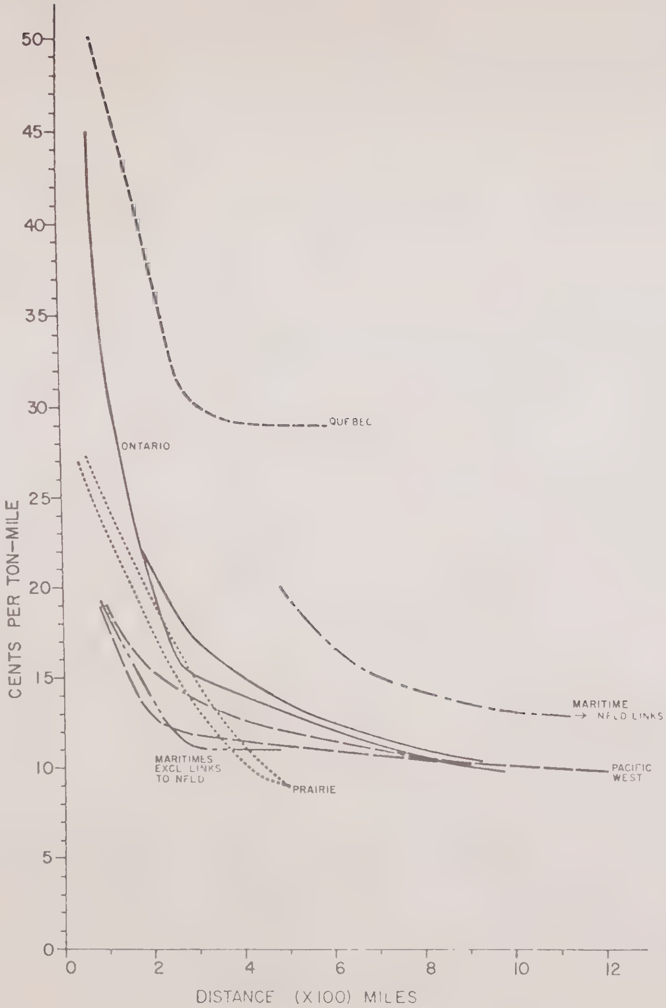
The truck rates shown by region for a 10,000 pound shipment of general cargo demonstrate a similar pattern among regions as that for truck-load shipments. It is interesting to note that Quebec and Ontario have substantially higher truck rates than those enjoyed by the Western Provinces, with Maritime rates lying between the two extremes. A number of factors could be involved in these differences, including union representation, degree of regulation, levels of traffic congestion, length of haul, size of trucking companies, Sunday trucking limitations, and others. The important point to note is that Western and Eastern Canada both enjoy lower truck rates that Quebec or Ontario and rail rates throughout the country are competitive with those offered by truck.

Deficits and Subsidies

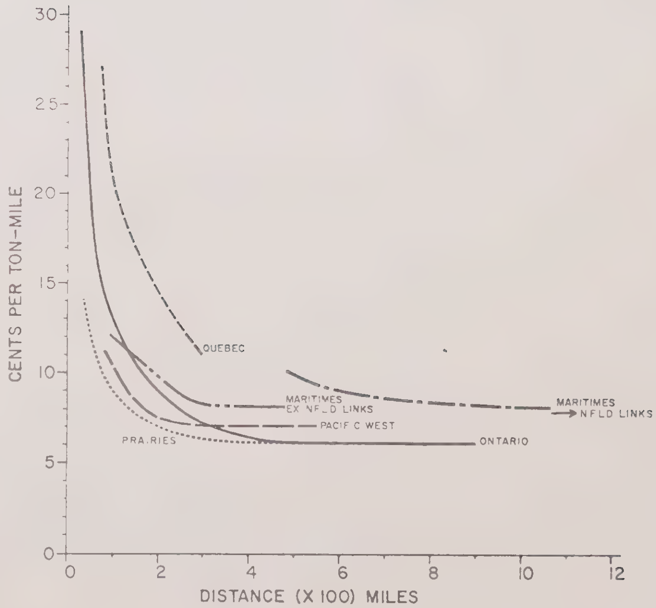
Given the mixture between public and private ownership and operation of Canada's transportation system, as noted earlier, it is interesting to calculate the proportion of the total capital and operating cost for each mode which is paid by users of the mode. As shown in Exhibit 14, in 1973 there was a 10% deficit between total costs and revenues



REPRESENTATIVE RATES: RAIL



INTRA-REGIONAL TRUCK TRANSPORT RATES
General Freight — 10,000 Lbs Shipment Size



INTRA-REGIONAL TRUCK TRANSPORT RATES
General Freight — 30,000 Lbs. Shipment Size

REPRESENTATIVE RATES: TRUCK

EXHIBIT 14

TOTAL TRANSPORTATION COST AND DEFICIT[1]

CANADA - 1973

(In Millions of Dollars)

Mode	Infrastructure[2] Cost ($M)	Vehicle Cost ($M)	Total Modal Cost ($M)	Modal Costs As a Percentage of Total Transport Costs (Percent)	Deficit for Each Mode ($M)	Deficit as a Percentage of Total Costs for Each Mode (Percent)
Air	354	1,163	1,516	6	243[3]	16
Marine	576	1,892	2,469	9	534[4]	22
Road	3,191	17,162	20,353	76	1,165[5]	6
Rail	661	1,771	2,548[6]	9	671	26
Total[6]	4,813	22,073	26,886	100	2,614	10

1. Total may not agree due to rounding.
2. At a 6 percent rate of cost of capital; in 1973 prices.
3. Includes $2.1 million in direct subsidies paid to regional air carriers.
4. Includes $67.7 million in direct subsidies paid to Canadian for-hire water carriers.
5. Includes $14.5 million in direct subsidies paid under the Atlantic Region Freight Assistance Act.
6. This figure in addition to rail infrastructure and vehicle costs also includes $115.2 million of corporate taxes and regulating costs for 1973, for rail.

Source: This Table is an Update of Table 6 in Z. Haritos' "Transport Costs and Revenues in Canada", Journal of Transport Economics and Policy, Volume IX, No. 1, January 1975.

Revised 11/4/75

for the four major modes, with rail showing a 26% deficit, marine 22%, air 16% and road 6%. These deficits, which totalled about $2.6 billion in 1973 for all four modes, are, in general, made up by various types of operating and capital subsidies from the federal and provincial governments, or by relatively low rates of return on investments. The bulk of the road deficit is made up by provincial governments, although this includes $14.5 million in direct federal subsidies paid under the Atlantic Region Freight Assistance Act. Other federal subsidies include approximately $100 million of rail operating subsidies, $68 million in direct subsidies to Canadian for hire marine carriers, $2 million in subsidies to regional air carriers, as well as capital grants and debt forgiveness to CNR.

If increased capital expenditures are required in the future to provide necessary capacity increases, and if operating costs rise faster than can be offset by productivity gains, as seems likely based upon the analysis presented earlier, it can be expected that these deficits will increase unless user charges are adjusted upwards. This is a major policy question, as discussed more fully in later sections.

Conclusions

We draw a number of conclusions based upon the above discussion of current freight transportation issues in Canada, as follows:

- large capital investments have been made to increase transportation capacities in all modes during the past few decades,

- a significant number of rail links, particularly through the western mountains and on certain Prairie links and links between Winnipeg and Thunder Bay, are approaching capacity limitations under current infrastructure and operating conditions, suggesting that capital expenditures by the railroads may have to increase in future, relative to past levels,

- significant capacity increases in road, rail, marine and air modes have been achieved since 1950 by larger and more efficient vehicles and bigger payloads; these productivity increases can be expected to level off to some extent as all modes tend to reach "saturation" in terms of vehicle size and motive power; productivity gains may therefore no longer be sufficient to offset rising operating costs,

- upward pressure on rates may be expected as a result of both of these trends: that is, to generate cash flow for capacity improvements and to meet rising operating costs, and

- overall, the level of service provided to shippers in various parts of Canada appears to be reasonably high and equitable in terms of quality provided and rates charged; some anomalies exist and will require corrective action as part of an on-going program of freight rate system improvement.

3. HOW IMPORTANT IS FREIGHT TRANSPORTATION IN CANADA

The question of the importance or essentiality of transportation is central as a basis for reviewing policy in this field. In this section we examine these questions, in both economic and social terms, form the point of view of the country as a whole and its various regions. In order to do so, we consider the situation as it existed in 1972 and as it might develop by 1990.

Economic Importance

Economic Scenarios

Canada is a major trading nation and is therefore heavily dependent upon world markets. We export large volumes of renewable and non-renewable bulk commodities, import large amounts of manufactured goods, and have large imports and exports of automobiles, automobile parts and farm machinery based on special trade agreements in these areas with the United States. The United States is our largest trading partner by far, for both bulk commodities and manufactured goods.

Our rate of economic development is therefore very dependent upon that of the United States, as it affects both our domestic economy and the market for our bulk commodities.

In addition, the rate and nature of our economic growth may be expected to depend on the economic policies which we follow in Canada, in particular industrial strategies aimed at more processing and manufacturing in Canada to provide a firm economic base, in addition to that generated by

our natural resources. There is some uncertainty in this respect, both in terms of future economic conditions at home and abroad and in terms of the nature and success of the industrialization policies we may choose to follow. In the face of such uncertainty, it is desirable that transport policy considerations be based on a range of future possibilities in order both that a desirable degree of flexibility can be built into any new policies, and that useful information can be generated to assist policy developments in fields other than transportation.

An econometric model of transport flows has been developed by the Canadian Transport Commission and can be used to estimate future freight traffic volumes. The model is conditional in the sense that the estimates of traffic flows are dependent upon assumptions as to the state of the Canadian economy in 1990. The volume of traffic flows by rail, for example, will obviously depend upon a vast number of economic variables. Nevertheless, the rate of change in Gross National Expenditure is the most important variable affecting the future state of the economy. This growth rate reflects a considerable number of variables, including labour participation rates, productivity, and the extent to which Canada decides to trade economic gains against other important non-economic considerations affecting the quality of life.

In the decade 1960-70, the average increase in GNE in Canada was 5.2% per annum; however during the period 1965-70, the annual rate of increase fell to 4.8%. Recognizing the large range of uncertainty in growth rates for the period 1975-90, a number of different assumptions

have been made as to the rate of growth in Canadian GNE. These are illustrated in Exhibit 15 as five "scenarios", as follows:

A. Control scenario assuming that the annual increase in GNE would be 4.5%, or just a little less than actually experienced in 1965-70.

B. High growth scenario, assuming a 5.7% annual rate of growth in GNE; this scenario is used to forecast maximum changes in transport flows and is likely to be far too high.

C. Moderately high growth scenario, taking the 5.2% per annum increase in GNE in 1960-70 and projecting this into the period 1975-90.

D. Moderately low growth scenario of 3.7% per annum, assuming that future growth rates will be less than those experienced in recent years.

E. Adjustment of scenario A to allow for acceleration over past rates in the development of domestic processing and manufacturing of Canadian raw materials.

Exhibit 15 shows the total domestic rail transport flows expected under each scenario by 1990. The rates of increase relate to tonnage loaded on the rail system; the increase in terms of ton-miles would tend to be greater than this, reflecting the current trend of an increasing average length of haul for rail transport. Taking the expected 1990 shipments under the control scenario A as index 100, the high growth scenario B generates in index of 115, the moderately high growth scenario C an index of 110 and the moderately low growth scenario D an

EXHIBIT 15

FUTURE ECONOMIC SCENARIOS

SCENARIOS	GROSS NATIONAL EXPENDITURE (Constant 1961 $ - billions)		UNEMPLOYMENT RATE - %	DOMESTIC RAIL FLOWS		
	Forecast 1985	% rate of growth per annum; 1975-85	Forecast 1985	million tons Forecast 1990	% rate of growth per annum 1972-90	Index Scenario A = 100
A. Control scenario	129	4.5	5.3	407	4.5	100
B. High growth	145	5.7	4.2	469	5.3	115.2
C. Moderately high growth	137	5.2	4.4	448	5.1	110.1
D. Moderately low growth	120	3.7	5.5	354	3.7	87.0
E. Scenario A adjusted for more rapid further processing/manufacturing in Canada	131	4.6	4.8	395	4.3	97.0

NOTES

1. Gross National Expenditure was forecast only to 1985, but the same rate of growth per annum was assumed to 1990 in calculating domestic rail flows.

2. Scenarios A, B and C have been calculated from full model simulations. Scenarios D and E are based partly on simulation and partly on transformation and extrapolation.

3. Population in 1990 is assumed to be approximately 27½ million.

index of 87. Under scenario E, where the rate of further processing and manufacturing in Canada is increased, the index has a value of 97. This is to be expected as a greater Canadian manufacturing content would generally tend to reduce the tonnage to be moved.

As a further basis for estimating future commodity flows, the Transportation Development Agency projected traffic volumes to 1990 based upon past trends and the judgement of experienced persons in industry and among the transport carriers. These forecasts represented a compound growth rate for all commodities of approximately 3.4% per annum, or very close to the moderately low growth scenario D compiled in Exhibit 15. A further range of growth estimates, falling between 3.5% and 4.9% per annum was provided by CNR and these were used to provide a range of traffic estimates on critical rail links. For purposes of presenting possible levels of commodity flows by 1990, we use here the more conservative estimates of a 3.4% increase per annum in commodity flows to 1990. These also provide a basis for discussing the economic importance of commodity transportation under future as well as present conditions.

Increases in Commodity Flows

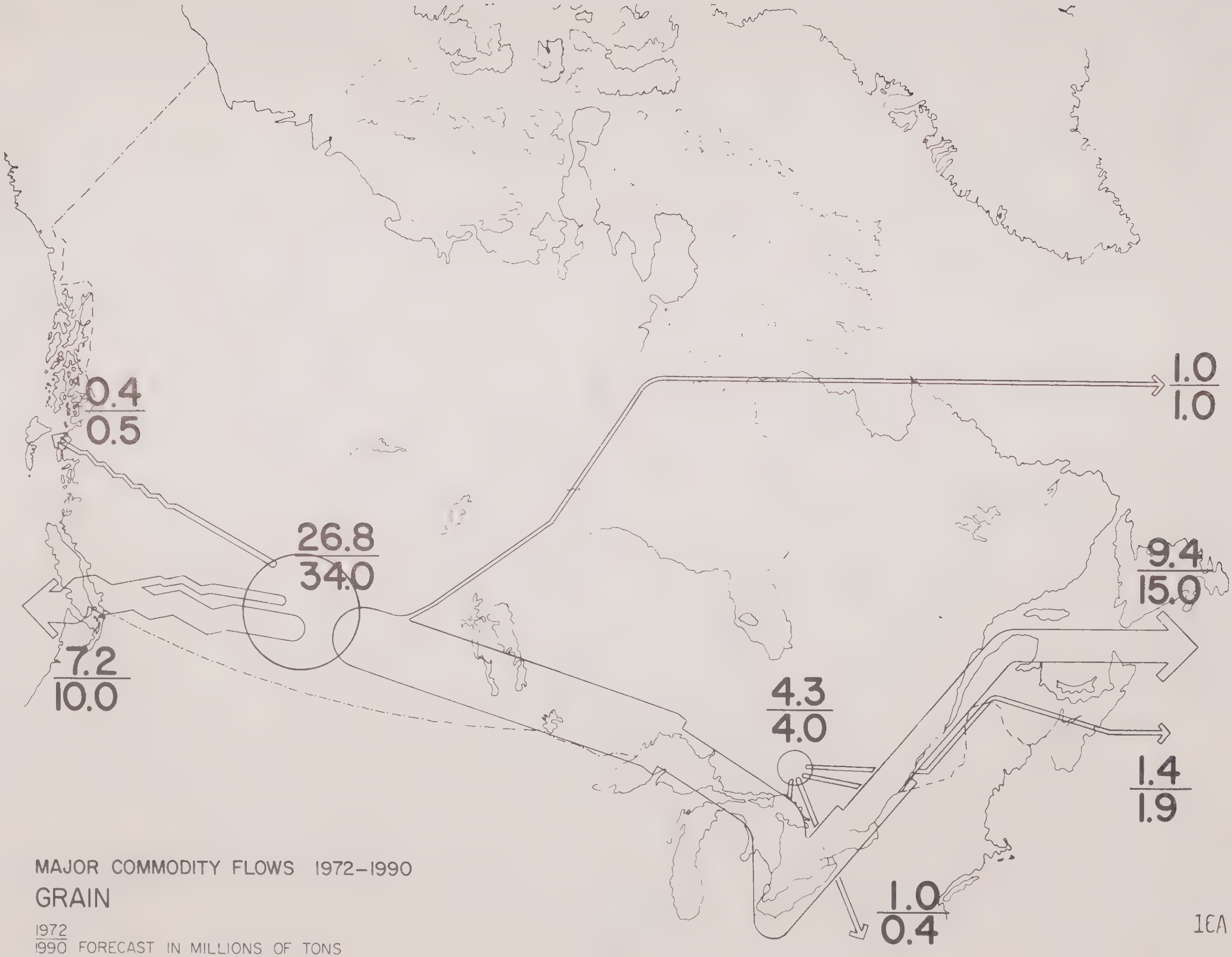
The various maps of Exhibit 16 show how major commodity flows may be expected to increase between 1972 and 1990. It can be seen that a number of the commodities, including iron ore, coal and potash, may be expected to increase by factors of two to three times, with renewable resources such as grain and forest products also showing sizable increases.

Some of the major commodity movements of the future include potentially great increases in the export of coal to Japan and shipments of coal from Alberta to Ontario; large increases in shipments of iron ore from Quebec-Labrador to the U.S. and abroad; and large increases in shipments of potash from Saskatchewan to the U.S. midwest.

In view of the large transportation capacity increases which will be required to carry such volumes, policy analysts might well ask whether it is in Canada's interest to make large transportation investments in order to ship non-renewable resources such as coal and iron ore abroad at a relatively low economic return to Canada. Alternatives in this regard, relating for example to further processing in the form of steel plants, in British Columbia and Quebec, are discussed briefly in Section 4 below. In the meantime, the measures of economic importance presented in the following subsection are based solely upon the estimated increase in export levels of the various commodities in raw form.

Production, Jobs and Income

Exhibit 17 shows recent production levels of major commodities by region across Canada, based on 1972 and 1973 data, and estimated 1990 levels of production based upon the conservative projections prepared by the Transportation Development Agency, as outlined in the previous sub-

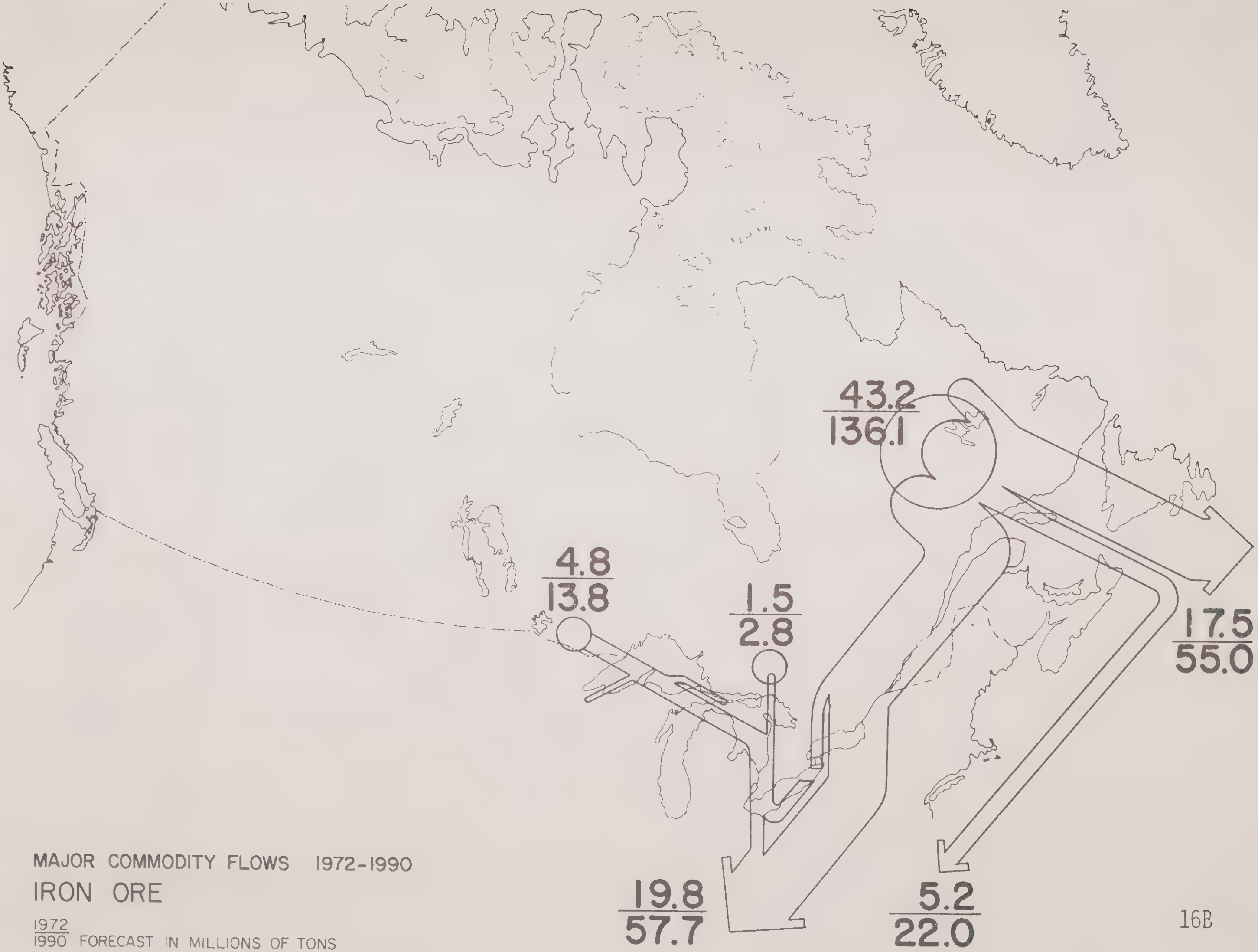


MAJOR COMMODITY FLOWS 1972–1990

GRAIN

1972/1990 FORECAST IN MILLIONS OF TONS

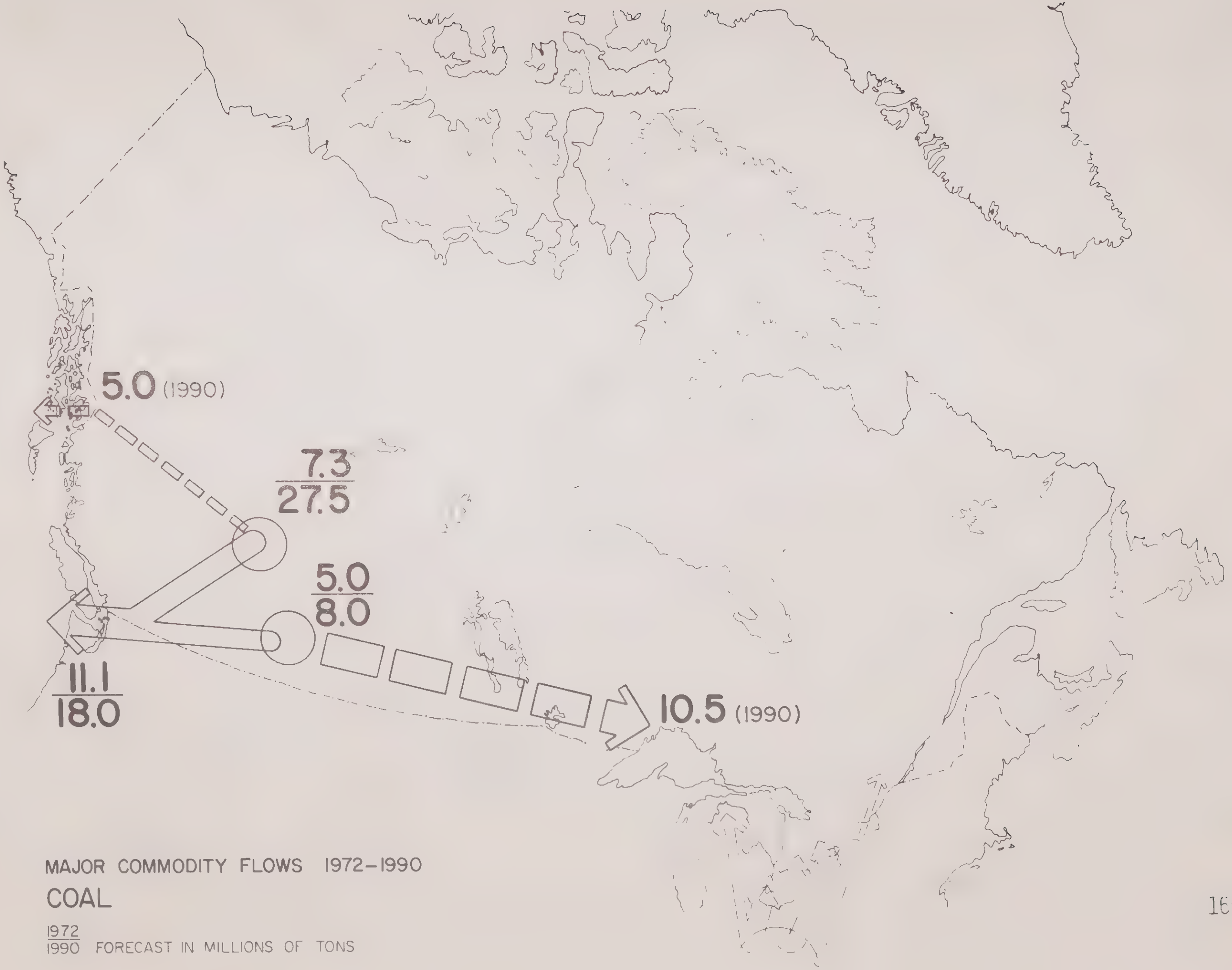
IEA



MAJOR COMMODITY FLOWS 1972-1990

IRON ORE

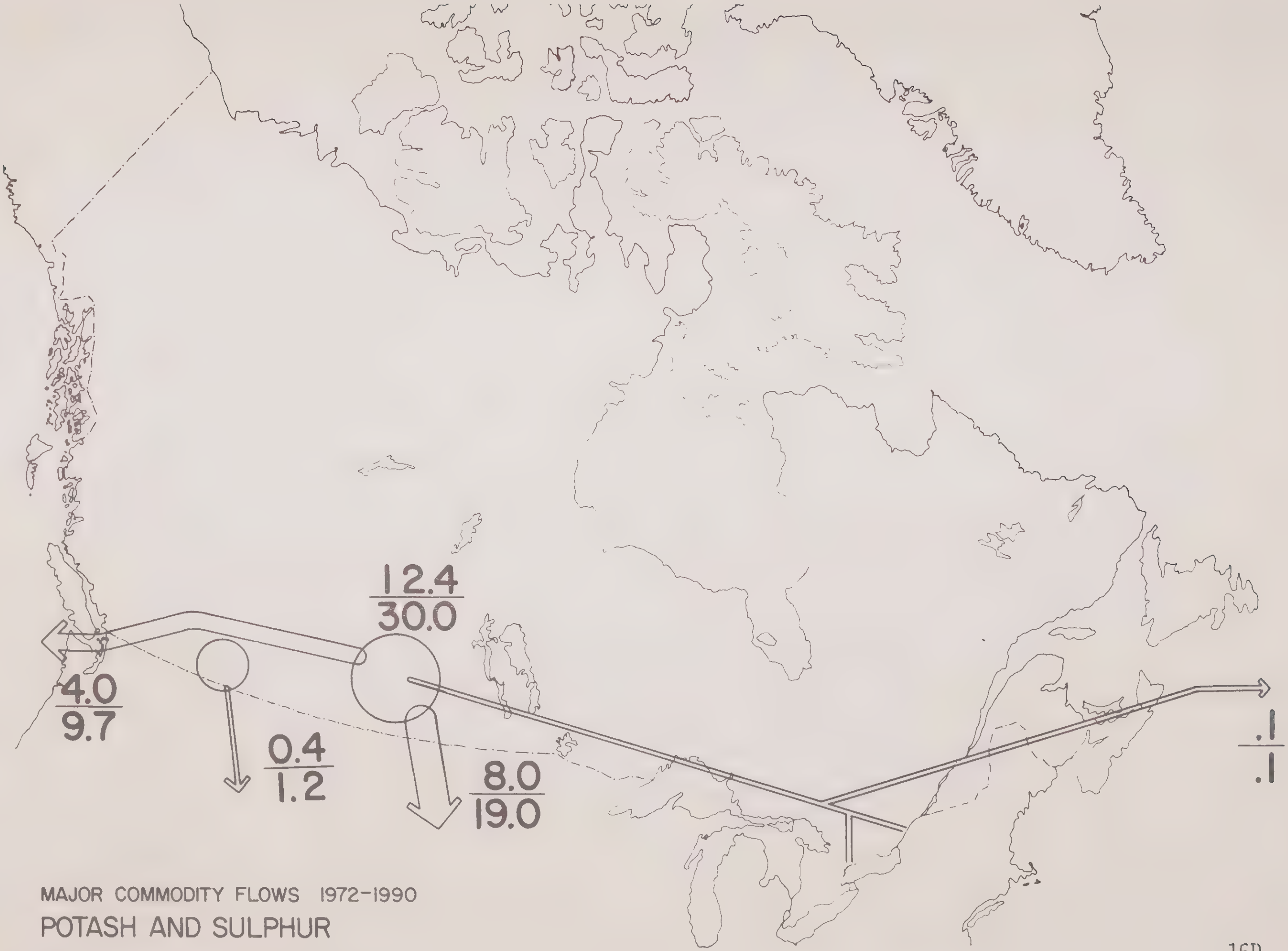
1972/1990 FORECAST IN MILLIONS OF TONS



MAJOR COMMODITY FLOWS 1972–1990

COAL

$\frac{1972}{1990}$ FORECAST IN MILLIONS OF TONS



MAJOR COMMODITY FLOWS 1972–1990

POTASH AND SULPHUR

1972
1990 – FORECAST IN MILLIONS OF TONS.

EXHIBIT 17

COMMODITY PRODUCTION BY REGION

(Millions of Short Tons)

(1972/73) 1990

<table>
<tr><th></th><th>Pacific (1)</th><th>Prairie (2)</th><th>Ontario</th><th>Quebec</th><th>Atlantic (3)</th><th>Canada</th></tr>
<tr><td>Coal</td><td>(7.8)
18.4</td><td>(13.2)
31.3</td><td></td><td></td><td>(1.6)
3.7</td><td>(22.6)
53.4</td></tr>
<tr><td>Iron Ore</td><td>(1.6)
4.4</td><td></td><td>(12.3)
34.3</td><td>(14.8)
41.2</td><td>(26.4)
73.3</td><td>(55.1)
153.2</td></tr>
<tr><td>Lumber</td><td>(15.5)
16.3</td><td>(1.3)
1.4</td><td>(1.4)
1.5</td><td>(3.5)
3.7</td><td>(0.8)
.9</td><td>(22.5)
23.7</td></tr>
<tr><td>Paper, Board & Wood Pulp</td><td>(8.2)
12.1</td><td>(2.1)
3.1</td><td>(7.7)
11.3</td><td>(12.1)
17.9</td><td>(4.2)
6.1</td><td>(34.3)
50.5</td></tr>
<tr><td>Potash</td><td></td><td>(4.7)
12.6</td><td></td><td></td><td></td><td>(4.7)
12.6</td></tr>
<tr><td>Sulphur</td><td>(0.3)
.6</td><td>(5.2)
10.3</td><td>(0.4)
0.8</td><td>(0.1)
0.2</td><td>(0.0)
0.1</td><td>(6.1)
12.0</td></tr>
<tr><td>Oil</td><td>(3.1)
11.3</td><td>(91.1)
61.1</td><td>(.1)</td><td></td><td>(0.0)
10.8</td><td>(94.4)
83.3</td></tr>
<tr><td>Grain</td><td colspan="2">(33.7)
38.9</td><td colspan="3">(2.1)
2.4</td><td>(35.8)
41.4</td></tr>
<tr><td>Steel</td><td></td><td></td><td></td><td></td><td></td><td>(14.8)
21.1</td></tr>
</table>

Notes: (1) B.C. Yukon and Northwest Territories
(2) Alberta, Saskatchewan and Manitoba
(3) New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland

section. As pointed out earlier, increases in production levels of non-renewable resources by factors of two to three are quite likely, with smaller but still substantial increases in the production of renewable resources.

Exhibit 18 shows the approximate 1972 and 1990 value of production for the same commodities, by region, in terms of 1973 dollars. The importance of paper, board and wood pulp, grains and oil and natural gas, each with about $3 billion worth of production in 1973, is apparent, followed by lumber at $1.6 billion, iron ore at $0.6 billion, coal at $0.171 billion and potash at $0.151 billion. The largest growth, however, is expected in coal and iron ore, as pointed out earlier, with paper, board and wood pulp also showing a major increase.

Exhibit 19 shows commodity related employment for 1972/73 and 1990 by region, again providing a measure of the importance of various commodities and their transport to each Canadian region, and the manner in which this employment may be expected to grow or decline during the coming 15 years. It should be noted that these employment and dollar value figures refer only to direct production of the commodities, and do not include multipliers for other activities, jobs and incomes generated by the basic, commodity-related employment.

The pattern of all three exhibits is clear. Coal in important to the Pacific, Prairie and Atlantic regions, iron ore to the Atlantic, Quebec and Ontario regions, lumber to the Pacific, Quebec and Ontario regions, wood pulp and paper to the Quebec, Ontario and Pacific regions, potash and sulphur to the Prairie region, oil to the Prairie region and grains to the Prairie region. These geographical patterns are expected to persist to 1990 and beyond.

EXHIBIT 18

COMMODITY - VALUE OF PRODUCTION

Millions of $

(1972/73) 1990

	Pacific (1)	Prairie (2)	Ontario	Quebec	Atlantic (3)	Canada
Coal	(85.6)	(66.4)			(19.2)	(171.2)
	202.6	157.3			45.3	405.2
Iron Ore	(13.9)		(145.0)	(128.3)	(325.8)	(613.2)
	38.7		403.4	356.7	906.2	1,705.0
Lumber	(1,116.0)	(92.3)	(116.4)	(246.4)	(60.6)	(1,631.7)
	1,177.8	97.5	122.8	260.1	64.0	1,722.1
Paper, Board & Wood Pulp	(749.6)	(98.9)	(778.1)	(1,099.4)	(401.8)	(3,127.8)
	1,128.7	149.0	1,171.6	1,655.5	605.0	4,709.8
Potash		(151.1)				(151.1)
		406.9				406.9
Sulphur	(4.5)	(65.4)	(6.8)	(1.6)	(0.6)	(78.9)
	8.9	129.6	13.4	3.1	1.3	156.3
Oil/Natural Gas	N/A	N/A	N/A	N/A	N/A	(2,980.0)
Grain	N/A	N/A	N/A	N/A	N/A	N/A
	3,157.9		276.3	3.2	0.5	3,437.9
Steel	N/A	N/A	N/A	N/A	N/A	N/A

Notes: (1) B.C., Yukon and Northwest Territories
(2) Alberta, Saskatchewan and Manitoba
(3) New Brunswick, Nova Scotia, Prince Edward Island

EXHIBIT 19

COMMODITY-RELATED EMPLOYMENT (1972/73) 1990

Thousands

	Pacific (1)	Prairie (2)	Ontario	Quebec	Atlantic (3)	Canada
Coal	(2.2)	(1.8)			(3.7)	(7.7)
	4.0	3.4			6.7	14.0
Iron Ore	(0.3)		(3.5)		(7.4)(4)	(11.2)
	0.6		7.3		15.7	23.6
Lumber	(32.6)	(3.5)	(5.6)	(11.2)	(4.2)	(57.1)
	26.2	2.8	4.5	9.0	3.4	45.9
Paper, Board & Wood Pulp	(16.5)	(2.1)	(21.0)	(29.5)	(9.9)	(79.0)
	18.5	2.3	23.6	33.1	11.1	88.5
Potash		(2.7)				(2.7)
		5.5				5.5
Sulphur		(1.0)				(1.0)
		1.5				1.5
Oil	(0.4)	(3.9)	(0.1)			(4.4)
	N/A	N/A	N/A		N/A	N/A
Grain	N/A	N/A	N/A	N/A	N/A	N/A
Steel	N/A	N/A	N/A	N/A	N/A	N/A

Notes:
(1) B.C., Yukon and Northwest Territories
(2) Alberta, Saskatchewan, and Manitoba
(3) New Brunswick, Nova Soctia, Prince Edward Island, Newfoundland
(4) Includes Quebec/Labrador

The differences between the 1972/73 and 1990 figures provide a measure of the growth in basic jobs and income which each region can expect if world markets persist for our bulk commodities and if transportation can be provided to move them to markets. Conversely, these differences provide a measure of the economic opportunities foregone if transportation capacity limitations were to force a cutback in production. In a later section, we discuss the implications of reducing exports of certain bulk commodities, particularly coal and iron ore, in favour of more processing and production in Canada based upon these resources.

Another measure of the economic importance of transportation is illustrated in Exhibit 20, which shows the number of jobs by region in the transportation and transportation equipment industries. Again, the approximately one million jobs in these industries are an important source of employment and income to every Canadain region with some 34% located in Ontario, 26% in Quebec, 16% in the Prairie region, 13% in the Pacific region and 11% in the Atlantic region.

Survival: Food, Energy, Defence

Another measure of the importance of transportation to the various regions of Canada relates to their self-sufficiency in terms of food and energy. There are really two levels of vulnerability here: one relates to the daily restocking of urban food supplies, for which all regions are very much dependent upon the trucking industry, and are vulnerable to interruptions of more than several

EXHIBIT 20

TRANSPORTATION EMPLOYMENT* BY REGION

1973

	Employment	Percent
Atlantic	121,000	11
Quebec	286,000	26
Ontario	374,000	34
Prairies	176,000	16
Pacific	143,000	13
	1,100,000	100

* Total Transportation Employment includes workers in both transportation and transportation equipment industries

days for many foodstuffs. The same type of vulnerability applies to medical and health-related transportation, although this would initially affect a smaller proportion of the population; interruptions in energy flows by pipeline would also be felt within a matter of hours or days. The other level is the longer-term requirement for moving bulk foodstuffs, in particular grains and livestock, as well as energy in the form of coal and oil, over long distances. While the bulk of fossil energy supplies west of the Ottawa River are provided by oil and gas pipeline, eastern supplies are dependent upon the ocean transportation system, and Ontario imports large quantities of coal via rail and laker from the U.S. Exhibit 21 provides a very approximate assessment of the vulnerability of each Canadian region to transportation interruptions of two months or more in major commodities. While these measures are very rough and subject to considerable question, they provide another indication of the importance of reliable transportation to each Canadian region, both producing regions in terms of jobs/income, and receiving regions in terms of food, energy and industrial production.

Our ability to respond to emergencies of various types depends heavily upon our transportation system. The present system provides a capability to move large volumes of persons and materials east-west across Canada. As discussed in the following section, high capacity ground facilities (rail, road) are now being pushed into the

EXHIBIT 21

VULNERABILITY BY REGION TO COMMODITY FLOW INTERRUPTIONS

	British Columbia	Prairies	Ontario	Quebec	Atlantic
COAL	M	M	M	L	M
IRON ORE	L	L	M	L	L
STEEL AND PIG IRON	L	L	L	L	L
LUMBER	H	M	H	H	M
NEWSPRINT AND WOODPULP	M	L	M	M	L
POTASH	L	M	H	L	L
SULPHUR	L	L	L	L	L
OIL	H	H	H	H	H
GRAINS	L	M	L	L	L

* Short term is defined as 2 months

L - Low
M - Medium
H - High

the North in several parts of Canada. It is important that decisions on the type of infrastructure to be provided for northern transportation take into account not only the immediate transportation needs but the potential of various types of transportation facility for meeting other transportation, regional development, defence and social requirements.

Social Importance

National Goals

National goals and the role of transportation in relation to them were discussed in earlier sections of this paper. It was pointed out that a number of the goals, which relate strongly to the quality of life, depend heavily upon Canada's having and maintaining a sound economy. Only if our national income continues to keep pace with population growth and social aspirations will we be able to enjoy the benefits of quality-related goals. Transportation, particularly for passengers but also for freight, can contribute to the meeting of socially-oriented goals, such as distribution of regional development and wealth, reinforcement of national unity, and assertion of our sovereignty in remote areas. The main contribution of the freight transportation system, however, will remain that of supporting the necessary economic base, without which the other national goals would be difficult if not impossible to achieve.

4. FUTURE TRANSPORTATION PROBLEMS AND OPPORTUNITIES

Previous sections of this report have described the existing freight transportation system and its historical development, past and present traffic volumes, expected increases in freight transportation demands, and the importance to Canada's economic and social well-being of meeting some or all of these demands. In this section, we examine the manner in which future freight traffic would probably be carried by the system, transportation links on which capacity deficiencies may be expected between now and 1990, improvement options for meeting capacity deficiencies, non-transportation policy options which may reduce certain transportation demands, and the financial implications of these options.

Capacity Requirements and Options

In the previous section, we presented estimates of future commodity flows among Canadian regions and to and from the rest of the world. We examine in this subsection the volume/capacity implications of these for each major freight transportation mode (rail, marine, road), alternative means of providing any additional needed capacity and a preliminary assessment of the capital investment implications of these options.

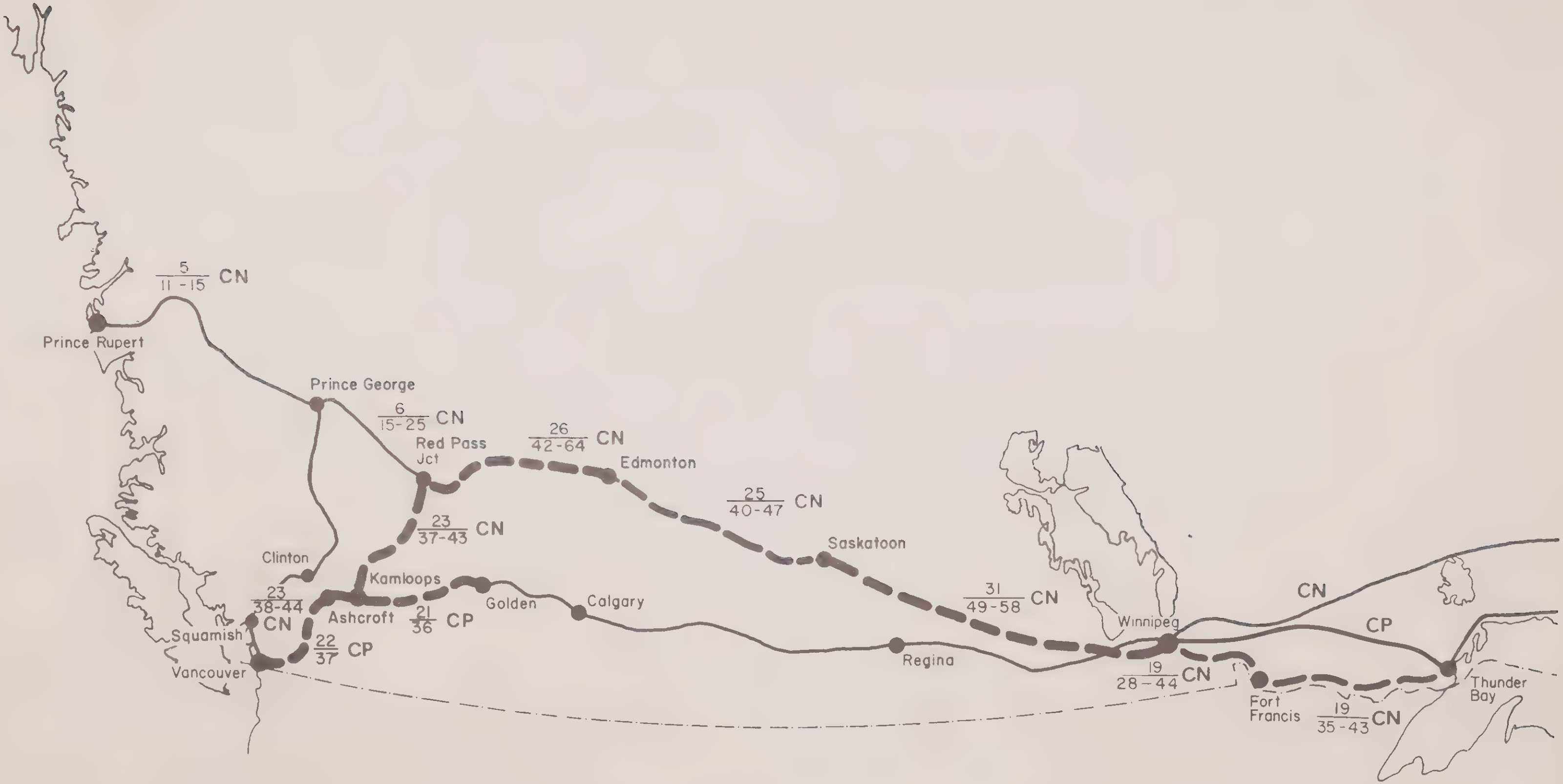
In this subsection we consider diversion of traffic volumes from one mode to another, operating improvements, physical expansion of existing infrastructure links and system extension by means of new links, as means of achieving required additional capacity. Non-transportation options are considered in the following subsection.

Rail

A range of future traffic volumes was assigned to the rail and marine transportation network using the 1990 volume estimates produced by the Transportation Development Agency as the lower end of the range, and, as outlined earlier, the higher estimates prepared by Canadian National as the upper end of the range for CN lines. The results of this analysis are shown on Exhibit 22, which identifies the critical rail links which are expected to experience capacity limitations before 1990 and shows the range of trains per day which may be experienced on those links. As discussed briefly below, capacity limitations may be significant for most or all sections of the CN mainline between Vancouver and Thunder Bay and the CP mainline between Vancouver and Winnipeg.

As shown, the most critical links are between Edmonton and Red Pass Junction, presently carrying about 26 trains per day (both directions) and expected to carry 42 - 64 trains per day by 1990; the link between Vancouver and Red Pass Junction (23 trains per day growing to 37 - 44); the link between Edmonton and Saskatoon (25 trains per day growing to 40 - 47); the link between Saskatoon and Winnipeg (31 trains per day growing to 51 - 58); the link between Winnipeg and Fort Francis (19 trains per day growing to 28 - 44); and the link between Fort Francis and Thunder Bay (19 trains per day growing to 35 - 39).

The above links apply to the CN system. On a very approximate basis, and in the absence of any detailed engineering calculations, it is estimated that the capital investment required to expand the capacity of the above links, plus those joining Prince Rupert to Red Pass Junction and Winnipeg to Sudbury, would be about \$1.5 billion - \$2.8 billion, (1975 dollars) including an estimated \$1.1 - \$1.3 billion for yards and associated sidings. In addition to these capacity expansion costs, an estimated \$2.9 - \$3.5 billion may be required between 1975 and 1990 to replace existing plant on the required continuing basis, for the above



CRITICAL RAIL LINKS BY 1990

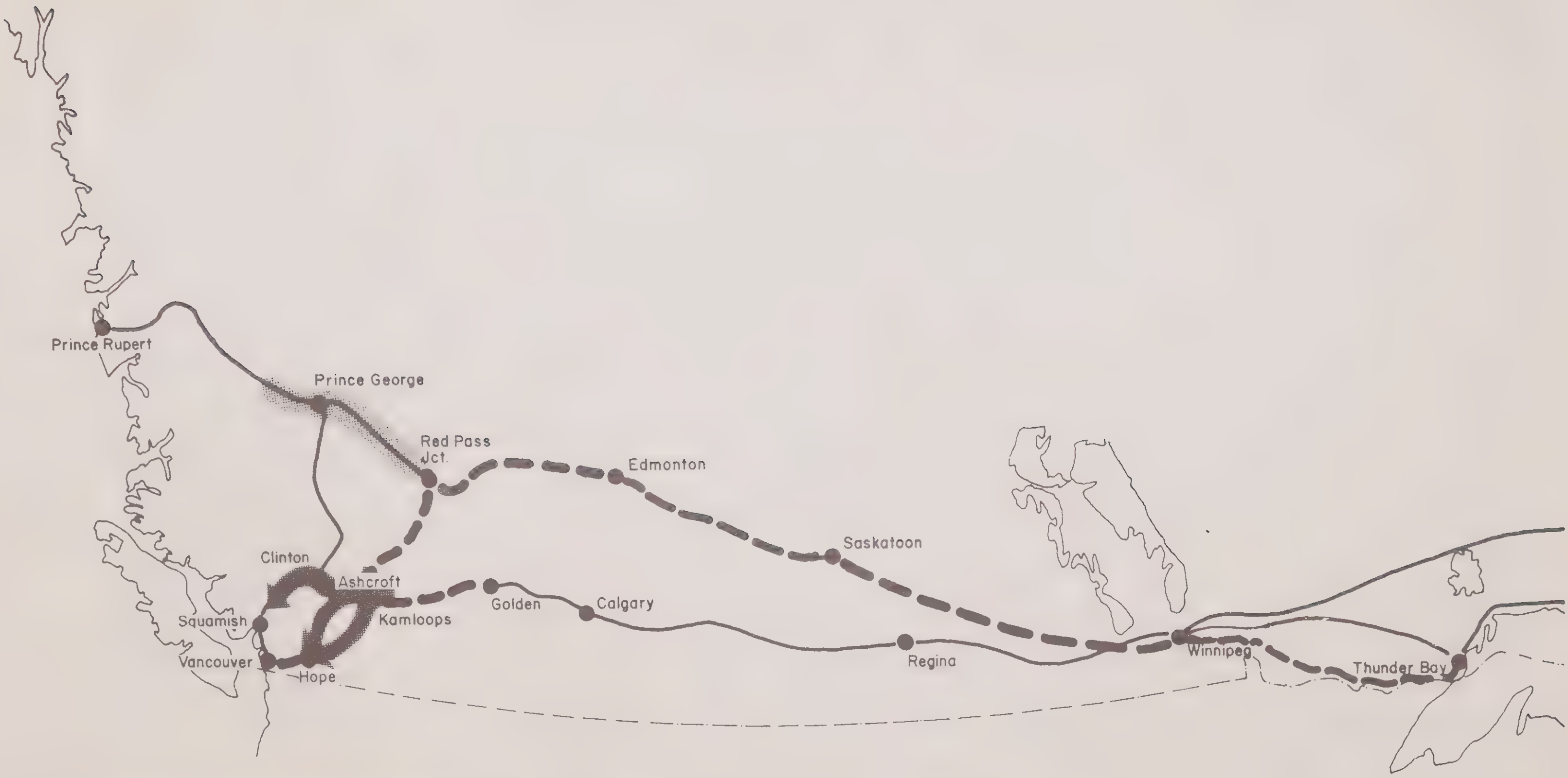
1972/1990 TRAINS PER DAY

links and associated yards. The substantial replacement costs include some "catching up" to upgrade the quality of certain links; they relate strongly to the need to replace rail every four or five years on heavily used lines, as discussed earlier in Section 2 of this chapter.

For CP Rail, the critical links are between Golden and Vancouver (24 trains rising to 39); between Golden and Calgary (20 trains per day rising to 33); Calgary to Regina (11 trains per day rising to 20); and Regina to Winnipeg (22 trains per day rising to 30). The 1990 figures are based on the TDA traffic estimates and are therefore lower than those shown above for the CN links. With the capacity of the mountain links estimated at 30 trains per day, capacity limitations on the Vancouver-Golden link will begin to be felt during 1976-1978. CP Rail has made application to double track the east slopes of the four mountain passes on this link, at a cost of about \$60 - \$70 million, which is expected to provide the necessary increased capacity through 1985.

Again, based upon very approximate estimates prepared by the Transportation Development Agency, it is estimated that the capital expansion costs for the above CP critical links would lie in the range \$210 -\$460 million to 1990, with related replacement costs in the range \$730 -\$900 million. It should be emphasized that the above cost estimates were produced on an approximate basis by TDA staff.

Exhibit 23 illustrates a number of possible options to meet expected rail capacity deficiencies in the western mountain region. While it is possible to double track much of the CN link between Edmonton and Red Pass Junction and the CP link between Calgary and Kamloops, it would be prohibitively expensive to double track certain portions of these links and larger portions of both main lines for the remainder of the



POSSIBLE OPTIONS TO MEET RAIL CAPACITY DEFICIENCIES

distance to Vancouver, owing primarily to the canyon conditions experienced in the Thompson and Fraser River Valleys. It has been suggested that joint operation of the two main lines between Kamloops and Vancouver, as a one-way couplet, would increase the capacity of this critical section significantly, but the Calgary/Edmonton-Kamloops sections would remain critical. While this may be true in theoretical operating terms, the limitations of track life and track replacement requirements, referred to earlier in Section 2 of this chapter, are such that combined operation with the existing number of river crossings between the two lines, would substantially limit effective capacity increases. If many more river crossings were built (at great expense) in order to allow trains to bypass sections undergoing track replacement, the number of trains per day which could be carried in both directions by both tracks under combined operation might be increased from the present capacity of about 57 trains per day to 70 - 80 trains per day or even as high as 100. The entire question of rail capacity in the mountain region is now under more detailed study.

Owing to the expected high cost of increasing rail capacity in the Fraser canyon, other options should be considered, as illustrated in Exhibit 23. These include:

- construction of the Clinton-Ashcroft link to the British Columbia rail line, construction of which has been agreed to in principle;
- construction of the Fraser Canyon bypass from Hope through the Coquihalla Valley via Merritt to Kamloops. Construction of a road is now being considered along this latter link and the option of building a rail line as well as the road should be carefully considered before a road design is finalized. It should be pointed out that the terrain for the Coquihalla Valley bypass, from Hope to Kamloops, is quite rough. The proposed Ashcroft-Clinton link referred to earlier

would require considerable upgrading to carry heavy volumes. Both of these alternatives would therefore be quite expensive. It should also be pointed out that there may be environmental difficulties with the construction of a major commodities port at Squamish.

As shown in Exhibit 23, there are a number of permutations of these options, under which greater or lesser volumes of traffic might be diverted to Prince Rupert, for example.

The key point here is that rather large capital investments will be required for any of the options in order to make the necessary operational improvements, which might include electrification to obtain increased power and therefore greater capacity, and infrastructure expansions. Modal substitution is not an option in this area unless it were decided to divert greater traffic volumes eastward through Great Lakes and/or eastern seaboard ports; capacity limitations on eastbound rail lines, as noted earlier, would make this an expensive option also, and large diversions would place demands on the Welland Canal and St. Lawrence Seaway, which would also require major investments.

There are a number of new rail links which are either planned or committed to provide northerly extensions of the rail system. These include new links in Northern British Columbia and the Yukon Territory, Northern Alberta and the Northwest Territories, Northern Quebec and Labrador. The new links in the northwestern part of the country total about 700 miles, and have an estimated capital cost of about $500 million. Those in Quebec and Labrador, including increased rail

capacity from Lac Albinel to Lac St. Jean and other system expansions by the Quebec North Shore and Labrador and by the Quebec Cartier Railway are expected to have a capital cost of about $250 million.

Another major area which will require substantial capital investment is the grain handling and transportation system. As described in a number of reports, the railways are applying for the abandonment of some 6,000 miles of Prairie rail branch lines, and a Commission of Enquiry has been set up to determine how many miles of lines should in fact be maintained. Even with the abandonment of some lines, substantial capital expenditures would be required to maintain and improve the system. CN and CP estimate that some $600-$800 million capital investment could be required to make the necessary improvements to rail plant and equipment on the Prairies. Unit train operations for grain, would also require major investments in terminals by the elevator companies.

Marine

Assuming that iron ore shipments through the Welland Canal by 1990 lie in the range of 30 to 55 million tons, the expected volume passing through the Welland Canal by 1990 may reach about 85 to 110 million tons, with about 75 to 100 million tons flowing annually through the St. Lawrence Seaway section joining Lake Ontario to Montreal. With

marginal improvements - costing approximately \$50-\$60 million - the expected capacity of both canals will be about 90 million tons per year, so that the lower range of estimated 1990 volumes could be handled with limited capital expenditures. It should be pointed out however, that the higher range of estimated future canal volumes based in particular on iron ore shipments from Quebec/ Labrador to U.S. Great Lake ports, and/or diversion of more grain through Thunder Bay, could bring capacity limitations into play before 1990, particularly on the Welland Canal. Should this happen, there is a possible mode substitution of rail for marine to overcome such a problem, by which grain might continue to travel to east coast ports via unit train with iron ore being shipped by unit train from Quebec to the U.S. or taken in greater quantities by ocean transport from Quebec to U.S eastern seaboard ports.

Traffic through the Welland Canal illustrates an important example of the need for overall planning and monitoring of private decisions by the Government of Canada. Movements of iron ore from Quebec to the U.S. via Lake Erie ports, and coal from the U.S. via Lake Erie ports to Hamilton and Toronto are based on these routings being less expensive than movements of iron ore via the U.S. eastern seaboard, or coal by unit train direct to Hamilton or Toronto. It is possible that with the expected growth of the commodity traffic as suggested above, large increases in iron ore traffic could bring the Welland Canal to a capacity limited condition,

triggering strong pressure for a federal investment of the order of $5 billion to expand and rebuild the Welland Canal. Under these conditions, a cheaper overall solution may be to divert to unit trains either U.S. coal movements to Ontario, or iron ore movements to U.S. steel mills from Quebec, or grain from Thunder Bay to St. Lawrence ports. Since it is impossible for an individual actor to take into account all relevant considerations, it is a Government of Canada responsibility to fill this role. If, in monitoring this situation, the Government of Canada were to determine that the use of unit trains would be more in the national interest, one option available to it would be to raise lockage fees on the Welland Canal to reflect more realistically the actual cost of building and maintaining this facility. This, in turn, could affect the plans of major shippers, such as U.S. and Canadian steel companies, leading to a more optimal overall transportation solution.

Exhibit 24 shows expected 1990 commodity volumes Canadian Ports, existing capacities of these ports, and the expenditures which may be required to raise capacities to necessary 1990 levels. These expenditures are expected to total about $1.2 billion between now and 1990.

Road

Exhibit 25 shows road links of the Canadian primary highway network which will be suffering capacity limitations by 1990 on the assumption that road traffic continues to grow at about 5% per annum compounded during the next 15 years. As was the case for Exhibit 8, congestion is defined as operating at Level D or worse, as defined by internationally-recognized standards, at the 30th highest hour of the year. It can be seen from the exhibit that most of the congested links occur in Ontario and Quebec, with

EXHIBIT 24

VOLUMES AND CAPACITIES FOR SELECTED COMMODITIES
AND EXPENDITURES FOR MAJOR PORT FACILITIES TO 1990

	Million Tons				$ Million
PORT	VOLUME HANDLED 1974	VOLUME FORECAST FOR 1990	ESTIMATED PRESENT CAPACITY	CAPACITY AFTER EXPANSION PLANNED/UNDERWAY	APPROXIMATE INVESTMENT REQUIRED TO ACHIEVE 1990 CAPACITY
VANCOUVER	22.02	47.39	37.9	-	119.0
PRINCE RUPERT	0.40	5.60	0.5	5.0	80.0
CHURCHILL	0.70	1.00	0.8	-	-
OTHERS IN B.C.	2.64	7.18	2.6	-	29.0
THUNDER BAY	20.60	55.70	30.3	42.6	160.5
SAULT STE. MARIE	2.40	5.00	4.7	-	-
WINDSOR	0.50	0.30	0.5	-	-
NANTICOKE	-	9.80	8.0	10.0	35.0
HAMILTON	3.80	6.90	6.3	6.9	12.0
TORONTO	7.10	11.20	7.5	11.5	28.5
MONTREAL	9.15	12.10	12.6	-	26.0
QUEBEC CITY	4.95	14.39	6.8	-	103.0
TROIS RIVERS	1.11	1.62	1.4	-	1.6
BAIE COMEAU	3.68	5.67	3.9	-	10.0
PORT CARTIER	9.90	28.90	22.5	-	60.0
POINTE NOIRE	6.20	16.60	15.0	-	9.0
SEPT ILES	28.30	73.80	40.0	-	140.0
CHICOUTIMI	-	10.00	-	-	40.0
LORNVILLE, N.B.	-	-	-	-	40.0
SAINT JOHN	2.08	5.39	3.8	-	33.0
HALIFAX	2.03	3.97	3.7	-	21.5
CANSO, N.S.	-	-	-	-	20.0
COME-BY-CHANCE	-	-	-	-	40.0
GOOSE BAY	-	-	-	-	40.0
OTHERS (Oil)	-	-	-	-	180.0
TOTAL	127,56	322.51	208.8		1,228.1

CRITICAL ROAD LINKS AND
CAPITAL EXPENDITURES TO 1990: PRIMARY NETWORK

few capacity problems in the Prairie Provinces and some in the other provinces. Also shown in the exhibit are the estimated capital expenditures which the provinces might be expected to make during the next 15 years to expand the capacity of these highway links, a total of some $9 billion. The federal proportion of this expenditure would be very low (about 4%) based on the assumption that past federal/provincial cost-sharing arrangements for highway links of this type would continue into the future. (The provincial expenditures shown are, in a number of cases, contingent upon this assumption.)

As pointed out earlier in Section 2, truck traffic is not a critical consumer of highway capacity in most cases. Truck traffic usually consititutes 20% or less of the traffic on a intercity highway, and is much less peaked than private automobile traffic. A number of policy options could be considered which would reduce private automobile traffic, particularly at peak times, thereby lessening the pressure for capacity expansion expenditures and easing the cost of congestion delays to truckers. These include higher fuel prices, higher fuel taxes, higher camping fees at federal and provincial parks, particularly for non-residents, and possible prohibition of the use of certain highway links by recreational vehicles. Any actions of this type would, of course, require detailed federal/provincial consultation and agreement.

There has been a trend of general cargo from rail to truck carriage during the past few decades, which has contributed to the rapid growth of truck volumes, particularly in and around our major urban centres. It is possible that higher fuel costs, greater road congestion, and more effective use of piggybacking will arrest or reverse this trend. This would marginally ease road congestion on heavily travelled intercity links, but would have no effect on major urban roads between rail yards and the ultimate urban destinations and origins of such goods.

Figure 25 also shows committed or proposed major road extensions into Northern Canada, including links into the Yukon and Northwest Territories and major new roads in the Quebec, James Bay and Labrador areas. The map also shows the Quebec-Labrador highway with its proposed tunnel to Newfoundland, although it is important to note that no commitments have been made for this major road link, which could have a capital cost in excess of $1.5 billion.

It is important to note that, with the construction of major north-south road and rail links, the Canadian transportation system is becoming considerably more than the original east-west connections of rail, water, road and pipeline which were built to create and maintain Canada as a national entity. The new north-south links are necessary to bring mineral and energy resources to the population centres of North America and overseas. An important policy question, which transcends transportation considerations, is the manner in which the new north-south links will be used. If Canada is to maintain control over its recources and economy, it is essential that the north-south links be used as feeders to our existing east-west transportation system, and to our own processing plants and industry to the maximum extent possible, rather than acting simply as conduits to move natural resources to U.S. markets and through the U.S. to world markets. The transportation aspect of this question requires that east-west land links and port capacities be increased to allow us to distribute the new resource volumes throughout Canada and abroad under Canadian control. The non-transporation implications are discussed further in the following subsection.

Non-Transportation Options

It was pointed out earlier that the most dramatic growth rates are estimated for two of our non-renewable resources during the next 15 years: coal and iron ore. The major coal movements are from Eastern British Columbia and Alberta westbound by rail to Pacific ports for export to Japan and from the same origins eastbound by rail for Ontario power generation purposes. Ironically, these movements are expected to involve some cross haul, with westbound coking coal from Alberta mines crossing eastbound thermal coal from British Columbia mines, thereby adding to traffic problems on CN's Edson subdivision.

At least two non-transporation alternatives could be considered to relieve the pressure from growing coal volumes. One of these is the creation of a steel mill or steel mills in British Columbia to use some of our coal output and a restriction on the amount of coal exported as such to Japan. This alternative is now being actively studied by the Department of Regional Economic Expansion and the British Columbia Government, with the possiblity being considered of using Canadian (Quebec-Labrador) or Brazilian iron ore and exporting some of the steel production to Japan which would be involved as part owner of the steel mill operations. The other non-transportation option would be to carry out large-scale coal gasification in Alberta and transmit gas to Ontario as a source of energy rather than transporting the coal as such. While this alternative will require further technological development and may be a decade or more away, it could represent one means of easing the load on eastbound rail links toward the end of the period under study in this report. The Province of Quebec is also actively studying the implementation of one or more steel plants in the St. Lawrence Valley, as a means of utilizing the large available supply of iron ore

and adding to domestic processing of our natural resources. Such developments would tend to reduce somewhat a growth in iron ore shipments to the United States but would, in turn, require shipment of Nova Scotia and possibly United States coal to the new steel plants.

In terms of added income for Canadians, a further basis for the distribution of urban population away from our major centres, and the achievement of a broader base for industrialization, the desire of British Columbia, Alberta, Quebec and other provinces for further processing/manufacturing of our natural resources should be encouraged and actively assisted by federal policy. This also applies to further processing of renewable resources such as grains (e.g. noodles, whiskey) and forest products.

With the exception of coal gasification or a slurry pipeline to replace rail transport of Alberta coal to Ontario, however, it seems unlikely that such developments would have a major impact in reducing required transportation infrastructure and equipment expenditures. That is, as outlined earlier in Section 3, transport demands for bulk commodity movement would probably still be of the order of 80% of "control scenario" demands, and these would be sufficient to trigger most of the capacity investments discussed in this report. The other exceptions to this statement would be restrictions to the growth of exports of coal to Japan and iron ore to the United States and abroad; such actions would have to be studied carefully in terms of our ongoing relationships with these important trading partners. Negotiations of this type would be much more likely to succeed if they were to involve joint operations for further processing in Canada and continuing export from Canada of both processed and unprocessed resources, rather than on outright restriction on further exports of the raw resource.

Financial Implications

Infrastructure

Discussions with CN and CP have produced estimates of total system expansion and replacement costs, including both infrastructure and equipment (rolling stock) in the order of $12 billion. In earlier sections, we have shown estimates of $5.4 - $7.6 billion for capital expansion and replacement of the critical links and related yard facilities in the CN and CP rail networks and about $550 million for rail extensions into Northwestern Canada and Northern Quebec and Labrador.

If, to the above infrastructure costs, we add an estimated $3 - $4.5 billion dollars for the purchase of new and replacement equipment (locomotives and rail cars) and add additional amounts for expansion/improvement of other major railways and rail components of the grain handling system, we reach an estimated capital investment requirement for Canadian railways during the 1976 - 1990 period of $9 - $15.7 billion or approximately $600 - $1050 million per year. The low end of this range takes into account the possibility that traffic growth may be slower than that assumed by CN. Earlier sections also provided estimates of approximately $1.2 billion for marine infrastructure expansion at major Canadian ports. To this must be added $100 million covering improvements to Arctic ports for handling mineral resources, and about $200 million for the extension of the navigation season and other system improvements to the canals operated by the St. Lawrence Seaway Authority, plus a possible investment of $800 million in twinning five Welland Canal locks, giving a total marine infrastructure investment of about $1.5 - $2.3 billion, or about $100 - $150 million dollars per year during the next 15 years. This does not include the substantial additional cost - of the order of

$5 billion - which would be required to expand and rebuild the Welland Canal, should additional capacity be required in this facility, as discussed above. As noted earlier, an investment of approximately $9 billion in expansion and upgrading of the primary road system is envisaged, amounting to about $600 million per year for the next 15 years.

Rail Equipment

In terms of rail equipment, the estimate noted above relates to past investments of approximately $500 million in locomotives and rolling stock by CN during the past 5 years and approximately $400 million by CP over the same period. The estimate of $3 - $4.5 billion for the next 15 years allows for similar levels of expenditure plus expenditure on new equipment for other railways.

Marine Equipment

Considering marine equipment, the number of Canadian vessels of 1,000 gross tons and over engaged in coastal and inland (mostly Great Lakes) trade is currently just over 200. The gross tonnage of these is about 1.8 million tons and deadweight is about 2.55 million tons. The total investment (original cost of this fleet) was of the order of $900 million. It is estimated that private industry might add a gross tonnage of one to two million tons to handle the increased volume forecast to 1990 and to replace present ships, mostly for the Great Lakes fleet. At 1975 costs, including costs of coastal ships and icebreakers, this could call for an investment of roughtly $2.5 - $4 billion over the next 15 years, or about $170 - $270 per year.

Trucks

It is more difficult to estimate annual expenditures on relevant parts of the truck fleet, because of the difficulty of identifying trucks used for intercity carriage and the lack of knowledge about the private

trucking industry. We know, however, that there were about 1.8 million trucks operating in Canada in 1973; of these, it is estimated that 60,000 - 80,000 are used for intercity, for hire operations. If we assume that a further 40,000 trucks are used for intercity private trucking operations, we have a total of about 100,000 - 120,000 intercity trucks at present. Assuming that these are replaced approximately every ten years, and that the number of intercity trucks is increasing at approximately 5% per annum compound, we arrive at an investment in new and replacement intercity trucks of approximately \$4 - \$5 billion over the next 15 years, or approximately \$270 - \$330 million per year. Since this investment will be generated privately and likely with little difficulty, the estimate is not critical to this analysis.

Comparison with Past Investment Levels

These estimates are summarized in Exhibit 26, which shows the expected capital expenditure for each major mode, for infrastructure, equipment and total plant (replacement plus expansion) for the next 15 years in total and on an annual basis. This table shows an estimated \$16.5 - \$21.3 billion required for infrastructure, or about \$1,100 to \$1,420 million per year; \$9.5 - \$14.7 billion on equipment, or about \$640 - \$980 million per year; and \$26.0 - \$36.0 billion for total plant and equipment, or \$1,740 - \$2,400 million per year.

By comparison, the railways have been spending about \$320 million per year in recent years, marine about \$140 million per year and road (primary system) about \$650 - \$700 million per year. We conclude from this that annual capital expenditures for the road mode are expected in future to be similar in magnitude to past expenditures although proportionately larger, bearing in mind normal truck fleet and infrastructure expansion. Rail and marine expenditures on the other

hand will probably be more than double their recent levels during the next 15 years. While these increases are not out of line with expected increases in rail and marine traffic, they raise basic cash flow questions: can and should rates be raised to provide the necessary cash flow, or will increased government capital expenditures be necessary or desirable?

Pipelines

Average annual capital expenditures in energy (gas and oil) pipeline expansion during the period 1963-1973 have totalled $2.7 billion, or about $240 million per year. For comparison with the transportation investments of Exhibit 26, it is estimated that some $21 billion will be invested in energy pipelines during the period 1976-1985, or about $2.1 billion per year, including the cost of a Mackenzie Valley pipeline. As can be seen, pipeline expenditures are expected to be substantial, and will draw heavily on Canadian capital markets, in competition with transportation and other capital requirements. There will also be competition for manpower and scarce materials.

Conclusions

From the above findings, we draw the following major conclusions:

- existing levels of freight transportation service are generally adequate in all parts of Canada relative to levels of development and demand

- interruptions due to labour disputes are a major problem which appears to be worsening and affecting Canada's credibility as a supplier of commodities on the world market. The situation is exacerbated by the ability of a relatively small number of employees, in many instances, to interrupt major flows and affect the livelihood of thousands of Canadians.

EXHIBIT 26

PAST AND EXPECTED CAPITAL EXPENDITURES TO 1990

	Approximate average Annual Rate of Capital Expenditure 1963-73 Plant and Equipment (millions of current $)	Estimated Capital Expenditures, 1976-1990 (millions of 1975 dollars): Infrastructure (Plant) Total	Infrastructure (Plant) Per Year	Equipment Total	Equipment Per Year	Plant and Equipment Total	Plant and Equipment Per Year
Rail	320 -	6,000 - 10,000	400 - 670	3,000 - 5,700	200 - 380	9,000 - 15,700	600 - 1,050
Marine	140 -	1,500 - 2,300	100 - 150	2,500 4,000*	170 - 270	4,000 - 6,300	270 - 420
Road**	650 - 700	9,000	600	4,000 - 5,000	270 - 330	13,000 - 14,000	870 - 930
TOTAL	1,110 - 1,160	16,500 - 21,300	1,100 1,420	9,500 14,700	640 980	26,000 36,000	1,740 2,400

* Expansion and replacement of laker and coastal fleets, icebreakers, etc.

** Infrastructure includes primary highways only; equipment includes intercity trucks (for hire, private) and buses only; all private automobiles, urban trucks and buses are excluded; range shown for 1963-73 because data published for highway and trucking are not broken down in this manner.

NOTE: All forecasts are preliminary estimates and subject to revision as a result of further research.

- while there are some anomalies in terms of rates charged for certain commodities, which deserve and are receiving attention, our analysis of rates and levels of service indicates that overall truck-rail competition is effective for general cargo and container traffic, rail-marine competion is effective from Thunder Bay east and market competition has a moderating influence on some bulk commodity rates.

- investments required to provide needed increases in freight transportation capacity during the next 15 years will be larger, proportionately, than those required during the past 10 years because:

  - substantial new rail capacity must be added for the first time in many decades, and

  - increases in rail, road, marine and air productivity are beginning to level out as vehicle size and efficiency limits are reached

- it is therefore likely that transportation rates will have to be increased for many transportation services and/or government financial and management involvement will have to increase, in order to provide the necessary funds to expand the system and operate it effectively

- it will be necessary to choose from among the possible ways of providing needed additional capacity to find the most cost-effective solution, in terms of the best use of available modes, operational improvements, link expansions and extensions and possible non-transportation approaches to reducing transport demand and increasing value added in Canada; major freight capacity problems will occur on western rail links, particularly in the western mountain region, and possibly on the Seaway depending on the rate of growth of iron ore and other shipments.

- the Government of Canada must play a central planning role in studying alternative expansion options, monitoring private initiatives affecting transportation demand, and ensuring that the optimum course of action is followed;

- Canada faces large, rather "lumpy" expenditures to increase the capacity of portions of our freight transportation system; the required expenditures will vary depending

upon traffic growth experienced and related government policies; it will be necessary to devise an investment strategy which takes into account the uncertainty inherent in this situation and minimizes the possibility of over-investment, while providing the flexibility needed for more rapid expansion if necessary.